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**SURVEY OF CHEMICAL CONTAMINANTS
IN THE BOTTOM SEDIMENTS OF GRAYS HARBOR ESTUARY**

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ABSTRACT

EPA priority pollutants/hazardous substances list compounds, resin acids, guaiacols, fatty acids, selected herbicides, polychlorinated dioxins, and polychlorinated furans were analyzed in sediment samples collected from ten sites in Grays Harbor estuary during May of 1988. The results indicated the level of chemical contamination was relatively low and generally comparable to non-urban reference areas in Puget Sound. Although sediments collected at two pulp mill outfalls in the harbor had concentrations of several organic compounds--polycyclic aromatic hydrocarbons (PAH), 4-methylphenol, dibenzofuran, retene, and two phthalate acid esters--which appeared elevated relative to reference areas, concentrations did not exceed thresholds for adverse effects that have been determined through chemical analysis, infauna assessment, and bioassays of Puget Sound sediments. Amphipod bioassays (*Rhepoxynius abronius*) of sediments collected in the vicinity of the outfalls showed no short-term (ten-day test) toxicity. Trace amounts of 2,3,7,8-tetrachlorodibenzofuran and related compounds were detected near the outfalls.

INTRODUCTION

Evaluation of coded wire tag returns since 1983 by the Washington State Department of Fisheries (Fisheries) has shown the survival rate of coho salmon from the Chehalis River drainage to be substantially lower than for coho originating in nearby Humptulips River drainage (Seiler, 1989). Fall chinook salmon may be affected to a greater extent than coho (Schroder, 1988, personal communication). As a result of these findings, a two-year, multi-agency study lead by Fisheries was begun in 1988 to determine the cause of the problem. The National Marine Fisheries Service, U.S. Fish and Wildlife Service, Oregon State University, University of Washington, U.S. Environmental Protection Agency (EPA), and Washington Department of Ecology (Ecology) are co-participants in the study.

One hypothesis being tested is that water quality in inner Grays Harbor is adversely affecting out-migrating smolts. In response to this concern, EPA and Ecology conducted a variety of chemical analyses and bioassays to assess potential toxicity and aid Fisheries in interpreting study findings. The Weyerhaeuser and ITT Rayonier sulfite pulp mills, the only large industrial discharges to the harbor, were a major focus of this work. Ecology's data-gathering efforts during the salmon survival study are summarized in Appendix A.

This report presents results of a survey, conducted during the first year of the salmon survival study, to assess the occurrence of toxic chemicals in the bottom sediments of Grays Harbor estuary. Previous sediment surveys have shown the level of chemical contamination in Grays Harbor to be relatively low (see discussion). However, sample collections have been confined largely to dredged portions of the estuary. Furthermore, certain classes of compounds of potential interest in the salmon survival study due to their presence in pulp mill effluents (resin acids, guaiacols, and dioxins, for example) had not been previously analyzed.

METHODS

Sampling Sites

Ten sites within Grays Harbor estuary were selected for sampling as shown in Figure 1; a description of each site is given in Table 1. The furthest upstream point at which sediments were collected was the Chehalis River above Cosmopolis. Sampling sites downstream of Cosmopolis included Elliott Slough, Cow Point, and three sites each in the North and South Chehalis River Channels. Sediments in the North Channel were collected at the ITT outfall, 100 yards below the outfall, and approximately 4.6 miles down-channel off Moon Island. South Channel sediments were sampled at the Weyerhaeuser outfall, 100 yards below the outfall, and approximately eight miles down-channel off Stearns Bluff. Samples in the North Channel and off Cow Point were taken outside the dredged portion of the channel; the South Channel is not dredged. Field and analytical variability were assessed at the Weyerhaeuser outfall where replicate sediment samples were collected and a duplicate laboratory analysis conducted on one set of replicates.

Sediments were also collected from the Humptulips River Channel in North Bay. The North Bay site was considered a reference area removed from local sources of contamination and

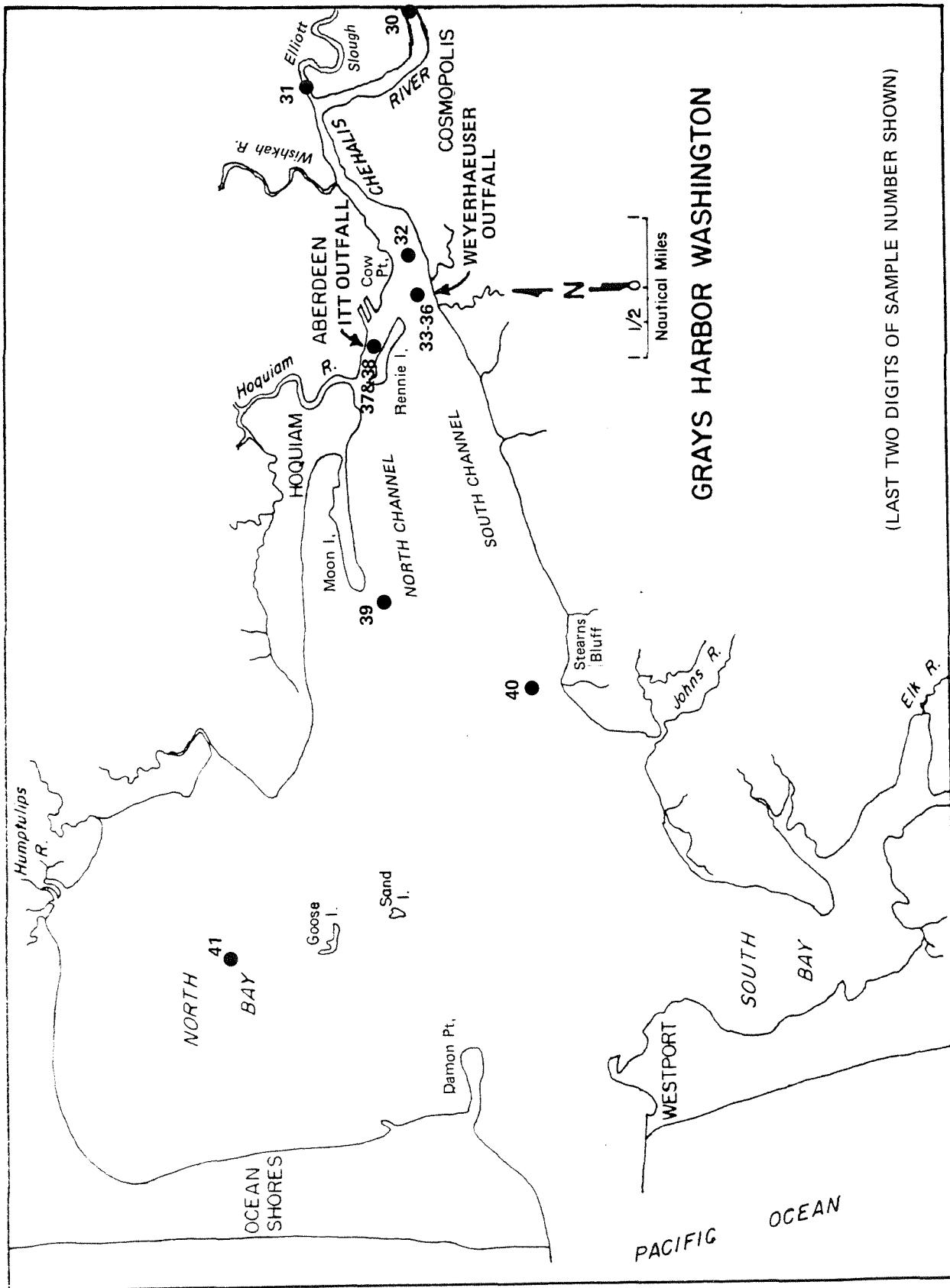


Figure 1. SEDIMENT SAMPLE LOCATIONS IN GRAYS HARBOR ESTUARY, MAY 23-24, 1983.

Table 1. Sediment Sample Locations in Grays Harbor Estuary, May 23 - 24, 1988

Site Name (Figure 1 designation)	Location Description	Lat. (46°N)	Long. (123°W)	Date	Depth (ft)	Time	Sample No. (22-)
Chehalis River above Cosmopolis (30)	Off left bank, 1000 yards upstream of overhead power cables, river mile 3.7	57°38"	44°55"	5/23	15	1030	8130
Elliott Slough near Mouth (31)	800 yards upstream of confluence with Chehalis River at river mile 2.9	58°45"	46°16"	5/23	20	1900	8131
Chehalis River off Cow Point (32)	South of dredged channel, midway between Charley Creek and flashing red 15ft. light on Cow Point	57°29"	50°26"	5/23	15	1230	8132
South Channel at Weyco Outfall (33-35)	Between dolphins marking outfall, downstream side of diffuser	57°22"	50°51"	5/23	13	1700	8133 8134* 8135**
South Channel below Weyco Outfall (36)	100 yards downstream of outfall	57°22"	50°55"	5/23	15	1800	8136
South Channel off Stearns Bluff (40)	600 yards north of bluff	55°40"	59°00"	5/24	28	1030	8140
North Channel at ITT Outfall (37)	Edge of dredged channel, downstream side of diffuser	58°05"	51°48"	5/23	28	1330	8137
North Channel below ITT Outfall (38)	Edge of dredged channel, 100 yards below outfall	58°05"	51°52"	5/23	32	1430	8138
North Channel off Moon Island (39)	North edge of dredged channel at green can buoy "35"	57°55"	56°58"	5/24	30	1130	8139
North Bay in Humptulips River Channel (41)	1.1 nautical mile north of Goose Island	59°58"	04°30" (124°W)	5/24	3	1230	8141

* replicate field sample

** laboratory duplicate of #8133

representative of sediment quality characteristic of a drainage with normal salmon returns. North Bay was used as a control station for experiments conducted during the salmon survival study.

It should be noted that the Cosmopolis sampling site (river mile 3.7) was potentially within the influence of pulp mill effluents and other discharges to the inner harbor. Measurements by the U.S. Geological Survey (USGS) have shown that saltwater intrudes as far upstream as Montesano (river mile 13), thus the upper limit of the estuary. Dye released by USGS at Rennie Island in the vicinity of the pulp mill outfalls traveled beyond Cosmopolis on flood tides (Beverage and Swecker, 1969).

Target Chemicals

Chemicals and ancillary variables analyzed in the sediments are listed in Table 2. Analysis for polychlorinated dibenzodioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs) was limited to samples collected in the vicinity of the pulp mill outfalls. These samples were also subjected to ten-day bioassays with the amphipod *Rhepoxynius abronius*.

Target chemicals included the EPA priority pollutants and hazardous substances list (HSL) compounds which constitute a broad range of approximately 140 different metals and organic compounds. Additional chemicals analyzed to detect the influence of pulp mill effluents were resin acids, guaiacols, catechols, fatty acids, PCDDs, and PCDFs. Because of problems encountered in the extraction and derivitization of catechols, no usable data were obtained on concentrations of these compounds. The sediments were also analyzed for atrazine, simazine, and pronamide which are potentially persistent herbicides. This analysis, by its nature, also includes several other miscellaneous pesticides not generally considered to persist in sediments.

Sampling Methods

Sediments were collected with a 0.1 m² stainless steel van Veen grab sampler. All samples were taken from the top 2-cm layer of material retrieved by the grab. Samples for analysis of volatile organic compounds were collected by filling 40 mL glass vials (no head space) from the initial grab at each site. Samples for other analyses consisted of a composite from two to three individual grab samples per station.

The composites were homogenized using stainless steel spoons and beakers, and split into subsamples. Sample-handling equipment was cleaned with Liqui-Nox(R) detergent, and sequential rinses with de-ionized water, dilute nitric acid, de-ionized water, and pesticide-grade acetone. The equipment was allowed to air dry, then wrapped in aluminum foil for transport into the field. Sample containers were 8-oz. glass jars with teflon lid liners, specially cleaned for priority pollutant analysis (I-Chem series 300, Hayward, CA). Grain size samples were put in polyethylene bags. All samples were placed on ice immediately after collection and transported to the Ecology/EPA Environmental Laboratory in Manchester, Washington, within two days.

Table 2. Target Chemicals and Ancillary Variables for Survey of Grays Harbor Estuary Sediments,
May 23-24, 1988

1. EPA Priority Pollutants/HSL Compounds:	
<u>Metals</u>	<u>Volatile</u>
Antimony	Carbon Tetrachloride
Arsenic	Acetone
Beryllium	Chloroform
Cadmium	Benzene
Chromium	1,1,1-Trichloroethane
Copper	Bromomethane
Lead	Chloromethane
Mercury	Vinyl Chloride
Nickel	Methylene Chloride
Selenium	Carbon Disulfide
Silver	Bromoform
Thallium	Bromodichloromethane
Zinc	1,1-Dichloroethane
Volatile (Continued)	
	1,1,1,2-Tetrachloroethylene
	1,1,2,2-Tetrachloropropane
	1,1,2,3-Trichlorobenzene
	Hexachlorobutadiene
	Naphthalene
	Total Xylenes
	2-Chlorotoluene
	1,2-Dichlorobenzene
	1,2,4-Trimethylbenzene
	DBCP
	1,2,3-Trichloropropene
	tert-Butylbenzene
	Isopropylbenzene
	p-Isopropyltoluene
	Ethylbenzene
	Styrene
	Propylbenzene

Table 2. (Continued)

1. EPA Priority Pollutants/HSL Compounds (Continued):

Semivolatile	Semivolatiles (Continued)	Pesticides/PCBs
Benz(a)pyrene	4-Bromophenyl-phenylether	4,4'-DDT
2,4-Dinitrophenol	2,4-Dimethylphenol	Chlordane
Dibenzo(a,h)anthracene	4-Methylphenol	Gamma-BHC (Lindane)
Benz(a)anthracene	1,4-Dichlorobenzene	Dieldrin
4-Chloro-3-Methylphenol	4-Chloroaniline	Endrin
Benzoic Acid	Phenol	4,4'-DDD
Hexachloroethane	bis(2-Chloroethyl)ether	4,4'-DDE
Hexachlorocyclopentadiene	bis(2-Chloroethoxy)methane	Heptachlor
Isophorone	bis(2-Ethylhexyl)phthalate	Aldrin
Acenaphthene	Di-n-Octyl phthalate	alpha-BHC
Diethylphthalate	Hexachlorobenzene	beta-BHC
Di-n-Butylphthalate	Anthracene	delta-BHC
Phenanthrene	1,2,4-Trichlorobenzene	alpha-Endosulfan
Butylbenzylphthalate	2,4-Dichlorophenol	beta-Endosulfan
N-Nitrosodiphenylamine	2,4-Dinitrotoluene	Heptachlor Epoxide
Fluorene	Pyrene	Endosulfan Sulfate
Carbazole	Dimethylphthalate	Endrin Aldehyde
Hexachlorobutadiene	Dibenzofuran	Toxaphene
Pentachlorophenol	Benzo(ghi)perylene	PCB - 1260
2,4,6-Trichlorophenol	Indeno(1,2,3-cd)pyrene	PCB - 1254
2-Nitroaniline	Benzo(b)fluoranthene	PCB - 1221
2-Nitrophenol	Fluoranthene	PCB - 1232
1-Methylnaphthalene	Benzo(k)fluoranthene	PCB - 1248
Naphthalene	Acenaphthylene	PCB - 1016
2-Methylnaphthalene	Chrysene	PCB - 1242
2-Chloronaphthalene	Retene	
3,3-Dichlorobenzidine	4,6-Dinitro-2-methylphenol	<u>Dioxin</u>
2-Methylphenol	1,3-Dichlorobenzene	
1,2-Dichlorobenzene	2,6-Dinitrotoluene	2,3,7,8-TCDD
o-Chlorophenol	N-Nitroso-di-n-propylamine	
Nitrobenzene	4-Chlorophenyl-phenylether	<u>Miscellaneous</u>
3-Nitroaniline	bis(2-Chloroisopropyl)ether	
4-Nitroaniline		Cyanide
4-Nitrophenol		
Benzyl Alcohol		

Table 2. (Continued)

2. Other Chemicals:

<u>Resin Acids, Guaiacols, Fatty Acids</u>	<u>Polychlorinated Dioxins</u>	<u>Polychlorinated Furans</u>
Linoleic Acid	TCDD (total) 2,3,7,8-TCDD	TCDF (total) 2,3,7,8-TCDF
Levopimaric Acid	PeCDD (total)	PeCDF (total)
Guaiacol	1,2,3,7,8-PeCDD	1,2,3,7,8-PeCDF
4-Allylguaiacol	HxCDD (total)	2,3,4,7,8-PeCDF
Oleic Acid	1,2,3,4,7,8-HxCDD	HxCDF (total)
Linolenic Acid	1,2,3,6,7,8-HxCDD	1,2,3,4,7,8-HxCDF
Sandaracopimaric Acid	1,2,3,7,8,9-HxCDD	1,2,3,6,7,8-HxCDF
Neoabietic Acid	HxCDD (total)	2,3,4,6,7,8-HxCDF
Abietic Acid	1,2,3,4,6,7,8-HpCDD	1,2,3,7,8,9-HxCDF
Tetrachloroguaiacol	OCDD (total)	HxCDF (total)
4,5,6-Trichloroguaiacol	1,2,3,4,6,7,8-HpCDD	1,2,3,7,8,9-HxCDF
Dichlorodehydroabietic Acid	Dichlorodehydroabietic Acid	OCDF (total)
9,10-Dichlorosteric		1,2,3,4,6,7,8-HpCDF
Dehydroabietic Acid		1,2,3,4,7,8,9-HpCDF
Palustric Acid		
4,5-Dichloroguaiacol		
Trichlorosyringol		
Isopimaric Acid		
4-Chloroguaiacol		

Miscellaneous Herbicides, Pesticides

Aldicarb
 Simazine
 Diuron
 Atrazine
 Butylate
 Metribuzin
 Fenamiphos
 Pronamide
 Hexazinone

3. Ancillary Variables

Grain Size
 Total Organic Carbon
 Dry Weight

Analysis

Analytical methods are described in Table 3. Extraction and analysis methods for semivolatile organic priority pollutants, resin acids, guaiacols, catechols, and fatty acids departed somewhat from routine protocols. For these analyses, the samples were extracted using SW 846 Method 3500 (EPA, 1986). Two solvents were used: acetone for eight hours to dry the sample, followed by methylene chloride for eight hours to complete the extraction. The sample was then concentrated, split ten percent for organochlorine (OC) pesticides and polychlorinated biphenyls (PCBs), and the remaining 90 percent placed in organic-free water and back-extracted by EPA Method 625 (EPA, 1984) using methylene chloride. This extract was then cleaned up using gel permeation chromatography at 2000 and 1000 molecular weight cutoffs. The extracts were then split 50/50 with one fraction analyzed for semivolatiles and catechols by gas chromatography/mass spectroscopy (GC/MS). The other fraction was derivatized using diazomethane and analyzed by GC/MS for resin acids, fatty acids, and guaiacols (NCASI, 1986).

Laboratory quality assurance and quality control procedures followed during the analyses are described in Kirchmer (1988) and Huntamer and Smith (1988). The accuracy and precision of the data were assessed by recoveries of matrix spikes, and matrix spike duplicates (selected samples), spikes of surrogate compounds (all samples), and through analysis of method blanks. These data are in Appendix B.

Matrix and surrogate compound spike recoveries were within limits required by the EPA Contract Laboratory Program except for the following semivolatile compounds which were not recovered in the matrix spikes (sample number 22-8131, Elliott Slough): benzoic acid, hexachloropentadiene, carbazole, 2-nitroaniline, 3,3'-dichlorobenzidine, 4-nitroaniline, 4-nitrophenol, 4-chloroaniline, and benzyl alcohol. Quality control limits have not been established for spike recoveries during analysis of resin acids, guaiacols, or fatty acids. Four compounds among these--4-allylguaiacol, 9,10-epoxystearic acid, trichlorosyringol, and 4-chloroguaiacol--were not recovered in the matrix spikes (sample number 22-8132, Cow Point).

As shown in Table 4, method blanks for organics analyses contained trace amounts of several compounds. Except for toluene, butylbenzylphthalate, and diethylphthalate, these compounds were also detected in field samples. These data have, therefore, been flagged (B) where presented in this report. However, only in the case of di-n-butylphthalate, di-n-octyl phthalate, bis(2-ethylhexyl)phthalate, and phenol, were method blank concentrations significant (i.e., within a factor of 10) relative to concentrations in field samples. The concentrations reported for these four compounds in Grays Harbor sediments may be largely an analytical artifact. The volatile compounds and phthalates detected in methods blanks for this survey are common laboratory contaminants during low level organics analysis.

In addition to duplicate matrix spikes, analytical precision was assessed through duplicate analysis of one set of samples collected at the Weyerhaeuser outfall. The results are in Table 5. Analytical variability was generally less than 30 percent (relative range of duplicates), except for lead and several organic compounds which exceeded 50 percent. Disparity between

Table 3. Analytical Methods for Grays Harbor Sediment Samples Collected May 23-24, 1988

Analysis	Method Description (No.)	Reference	Laboratory
antimony, arsenic, lead selenium, silver, thallium mercury	GFAA CVAA	EPA (1985) EPA (1985)	Ecology/EPA Environmental Laboratory, Manchester WA
beryllium, cadmium, chromium, copper, nickel, zinc volatiles	ICP purge & trap GCMS (8240)	EPA (1985) EPA (1986)	Ecology/EPA Environmental Laboratory, Manchester WA
semivolatiles	GC/MS (see text)	EPA (1984, 1986)	Ecology/EPA Environmental Laboratory, Manchester WA
organochlorine pesticides/PCBs cyanide	GC/ECD (8080)	EPA (1986)	Ecology/EPA Environmental Laboratory, Manchester WA
resin acids/guaiacols/fatty acids herbicides	GC/MS (see text) GC/NPD	EPA (1984, 1986) NCASI (1986) In-house	Ecology/EPA Environmental Laboratory, Manchester WA
PCDDs/PCDFs	GC/MS (8280)	EPA (1986)	Enseco California Analytical Laboratory, W. Sacramento CA
grain size	seives and pipettes	Tetra Tech (1986b)	Lauck's Testing Labs., Inc. Seattle WA
total organic carbon dry weight	induction furnace dry at 103° C	Tetra Tech (1986b)	Lauck's Testing Labs., Inc. Seattle WA
amphipod bioassay	10-day static exposure <u>Rheoxygnus abronius</u>	Tetra Tech (1986b)	EVS Consultants, Seattle WA

Table 4. Compounds Detected in Method Blanks for Survey of Grays Harbor Estuary Sediments, May 23-24, 1988 (ug/Kg)

Compound	Concentration		
	Blank #1	Blank #2	Blank #3
Volatiles:			
acetone	2J	2J	2J
2-butanone	0.6J	0.7J	0.6J
methylene chloride	7J	4J	4J
toluene	0.3J	0.3J	0.2J
Low Molecular Weight PAH:			
naphthalene	2J	4J	NA
Phthalates:			
di-n-butylphthalate	72J	37J	NA
di-n-octylphthalate	63J	15J	NA
bis(2-ethylhexyl)phthalate	210	100J	NA
butylbenzylphthalate	9J	ND	NA
diethylphthalate	4J	ND	NA
Phenols:			
phenol	10J	ND	NA
Resin Acids:			
dehydroabietic acid	5J	ND	NA

J = estimated concentration

ND = not detected

NA = not analyzed

Table 5. Duplicate Analysis of a Sediment Sample Collected at the Weyerhaeuser Outfall May 23, 1988
 (metals in mg/Kg, dry wt.; ppm -- organics in ug/Kg, dry wt.; ppb)

Sample No. (22-):	8133	8135	RPD(a)	Sample No. (22-):	8133	8135	RPD
% Gravel (>2mm)	<2	5	>86	Phthalates:			
% Sand (2mm - 62um)	79.0	78.9	0.1	di-n-butylphthalate	25	BJ	33 J 28
% Silt (62um - 4um)	17.4	17.3	0.5	di-n-octylphthalate	76	BU	46 BJ >49
% Clay (<4um)	3.6	3.8	5.4	bis(2-ethylhexyl)phthalate	320	B	270 B 17
% Total Organic Carbon	0.6	0.8	29				
% Dry Weight	71.8	67.5	6.2				
Metals:				Phenols:			
arsenic	3.5	3.4	3.0	4-methylphenol	46	J	77 U >50
beryllium	1.0	0.9	11				
chromium	29.0	28.9	0.4	Miscellaneous Extractables:			
copper	44.0	40.0	9.5	retene	76	U	64 J >17
lead	0.7	1.8	88	dibenzofuran	19	J	19 J 0
mercury	0.031	0.041	28				
nickel	65.0	62.5	3.9	Resin Acids:			
selenium	1.0	1.3	26	abietic acid	76	U	29 J >90
zinc	74.0	73.0	1.4	dehydroabietic acid	140	BJ	170 BJ 19
Low Molecular Weight PAH(b):				Fatty Acids:			
naphthalene	45	BJ	44	oleic acid	1400	J	510 J 93
1-methylnaphthalene	20	J	77	linoleic acid	76	U	170 J >76
2-methylnaphthalene	11	J	11				
acenaphthylene	4	J	4				
acenaphthene	31	J	30				
fluorene	23	J	22				
phenanthrene	110		120				
High Molecular Weight PAH:							
fluoranthene	95		100				
pyrene	110		120				
benzo(a)anthracene	19	J	23				
benzo(b)fluoranthene	76	U	20				

(a) relative percent difference (range as percent of mean of duplicates)

(b) polycyclic hydrocarbons; low molecular weight = 2-3 ring; high molecular weight - 4-6 ring

U = not detected at detection limit shown

J = estimated concentration

B = also detected in method blank

duplicate organics analyses occurred primarily where compounds were in the region of the method detection limit and concentrations were estimated. In comparing chemical concentrations between sampling sites for the present survey, differences less than those achieved in the duplicate may not be significant.

RESULTS¹

Physical Characteristics

The sediments appeared to consist of relatively clean sand and silt. The presence of unusual odors, petroleum sheen, or other discoloration was not observed. Sludge deposits were not encountered at or below either pulp mill outfall. Large amounts of wood debris littered the bottom of Elliott Slough.

Table 6 shows the grain size distribution and total organic carbon content of the sediments. Replicate field samples collected at the Weyerhaeuser outfall were similar in texture and organic content. For both the North and South Chehalis River Channels, percent fines (silt + clay fractions, <4 um - 62 um) and organic carbon tended to be higher near the pulp mill outfall in the upper channel than in the lower channel. Sediments in the lower South Channel and in the Humptulips River Channel in North Bay were much coarser (3.4 - 3.6% fines) and lower in organic content (0.2% organic carbon) than at other sites (21.1-86.6% fines; 0.7-3.0% organic carbon).

Priority Pollutants and HSL Compounds

Metals - The results of analysis for priority pollutant metals are shown in Table 7. Metals concentrations in the Weyerhaeuser outfall replicates agreed closely. Sediments at most sites had detectable concentrations of arsenic, beryllium, chromium, copper, lead, mercury, nickel, selenium, and zinc. Silver was detected only in the upper harbor at Cow Point, Elliott Slough, and Cosmopolis. Cadmium was detected only in the North Channel off Moon Island. Antimony and thallium were not detected at any site (0.1 mg/Kg detection limit).

Table 8 summarizes the metals data and shows detection frequencies, range of concentrations found in Grays Harbor compared to North Bay, and location of maximum concentrations. The range of individual metals concentrations in Grays Harbor sediments was generally narrow; for the most part, concentrations were comparable to those in North Bay. Maximum concentrations of the following metals were elevated by a factor of approximately two or more relative to North Bay: cadmium (0.9 vs 0.5 mg/Kg), chromium (35.0 vs 20.1 mg/Kg), copper

¹Chemical concentrations are reported on a dry weight basis in units of parts per million (mg/Kg) for metals and parts per billion (ug/Kg) for organics, except PCDDs and PCDFs which are in terms of parts per trillion (ng/Kg). The complete data set showing detection limits of all compounds analyzed is in Appendix B.

Table 6. General Physical/Chemical Characteristics of Grays Harbor Estuary Sediment Samples Collected May 23-24, 1988 (dry weight basis)

Location:	Chehalis R.	Elliott Slough	Chehalis R. off	S. Channel @ Weyco	S. Channel bw. Weyco	S. Channel off Stearns	S. Channel @ ITT	N. Channel bw. ITT	N. Channel off Moon	N. Channel Outfall	N. Channel Island	N. Bay in R. Channel
above Cosmopolis												
Sample No. (22-):	8130	8131	8132	8133/35(a)	8134(b)	8136	8140	8137	8138	8139	8141	
% Gravel (>2mm)	<2	<2	<2	3	<2	<2	<2	<2	<2	<2	<2	<2
% Sand (2mm-62um)	38.9	20.6	49.8	79.0	63.0	42.5	96.4	17.6	13.4	56.5	96.6	
% Silt (62um-4um)	47.7	61.6	37.4	17.4	29.4	45.9	3.2	64.5	67.2	34.5	2.9	
% Clay (<4um)	13.4	17.8	12.8	3.7	7.6	11.6	0.4	17.9	19.4	9.0	0.5	
% Total Organic Carbon	2.0	3.0	1.3	0.7	0.9	1.6	0.2	2.2	2.9	1.2	0.2	
% Dry Weight	47.1	39.3	53.5	69.6	58.6	53.0	74.8	41.7	35.8	52.5	76.2	

(a) mean of duplicate analyses

(b) replicate field sample

Table 7. Metals Concentrations Measured in Grays Harbor Estuary Sediment Samples Collected May 23-24, 1988 (mg/Kg, dry wt.; ppm)

Location:	Chenalis R. above Cosmopolis	Elliott Slough near Mouth	Chehalis R. off Cow Point	S. Channel at Weyco Outfall	S. Channel bw. Stearns Outfall	S. Channel at ITT Bluff	N. Channel at ITT Outfall	N. Channel off Moon Outfall	N. Channel bw. ITT Outfall	N. Bay in Humpulips R. Channel 8141
Sample No. (22-):	8130	8131	8132	8133/35(a)	8134(b)	8136	8140	8137	8138	8139
Antimony	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Arsenic	3.5	4.4	3.9	3.4	3.6	3.8	4.8	4.5	4.1	3.5
Beryllium	1.0	0.9	1.0	1.0	1.0	1.1	0.7	1.0	1.1	0.8
Cadmium	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Chromium	34.0	30.0	30.0	28.0	27.0	28.7	16.3	30.7	35.0	25.4
Copper	59.0	46.0	44.0	42.0	45.0	51.5	19.3	52.0	56.1	30.9
Lead	2.1	3.4	0.5 U	1.2	1.2	3.2	0.5 U	5.1	3.1	2.4
Mercury	0.081	0.051	0.029	0.036	0.044	0.071	0.014	0.055	0.048	0.034
Nickel	57.0	52.0	56.0	64.0	61.0	57.5	47.7	55.4	57.7	45.7
Selenium	1.1	1.9	0.8	1.2	0.9	0.9	0.7	0.7	0.4	0.1
Silver	0.33	0.11	0.05	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Thallium	0.01 U	0.01 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Zinc	73.0	76.0	71.0	74.0	75.0	77.1	51.6	77.1	80.8	58.6

(a) mean of duplicate analyses

(b) replicate field sample

U = not detected at detection limit shown

Table 8. Summary of Occurrence of Priority Pollutants and HSL Compounds in Grays Harbor Estuary Sediment Samples Collected May 23-24, 1988 (metals in mg/Kg, dry wt.; ppm--organics in ug/Kg, dry wt.; ppb)

Chemical	Detection Frequency(a)	Concentration Range in Grays Harbor	Concentration in North Bay	Location of Maximum
Metals:				
antimony	0/10	0.1 U	0.1 U	--
arsenic	10/10	3.4 - 4.8	3.8	lower S. Channel
beryllium	10/10	0.7 - 1.1	0.8	various
cadmium	1/10	0.5 U - 0.9	0.5 U	lower N. Channel
chromium	10/10	16.3 - 35.0	20.1	ITT Outfall
copper	10/10	19.3 - 59.0	30.6	Cosmopolis
lead	8/10	0.5 U - 5.1	0.5 U	ITT Outfall
mercury	10/10	0.014 - 0.081	0.017	Cosmopolis
nickel	10/10	45.7 - 64.0	56.3	Weyco Outfall
selenium	10/10	0.1 - 1.9	0.8	Elliott Slough
silver	3/10	0.02 U - 0.33	0.02 U	Cosmopolis
thallium	0/10	0.1 U	0.01 U	--
zinc	10/10	51.6 - 80.8	60.3	ITT Outfall
Volatile Organics:				
carbon disulfide	1/10	2 U - 8 J	6 U	Cosmopolis
acetone	1/10	4 U - 130	8 U	Cosmopolis
2-butanone	1/10	1 BU - 21 B	1 BU	Cosmopolis
methylene chloride	1/10	4 BU - 77 B	23 BU	Cow Point
trichlorofluoromethane	1/10	6 U - 12 U	7	North Bay
Total PAH(b):				
low molecular weight	9/10	20 BJ - 860 J	75 U	Weyco Outfall
high molecular weight	9/10	71 U - 1700 J	75 U	Weyco Outfall
Phenols:				
phenol	2/10	16 BJ - 24 BJ	75 BU	Weyco Outfall
4-methylphenol	6/10	46 J - 529	75 U	Weyco Outfall
Miscellaneous Extractables:				
retene	9/10	64 J - 540	75 U	Cosmop./ITT
dibenzofuran	5/10	19 J - 31 J	75 U	Weyco Outfall
N-nitrosodiphenylamine	1/10	71 U - 12 J	75 U	Weyco Outfall
Phthalates:				
di-n-butylphthalate	8/10	13 BJ - 35 BJ	20 BJ	Weyco Outfall
di-n-octylphthalate	4/10	15 BJ - 510 B	75 BJ	ITT Outfall
bis(2-ethylhexyl)phthalate	10/10	46 BJ - 610 B	57 BJ	ITT Outfall

(a) number of samples where chemical detected/total number of samples analyzed

(b) polycyclic aromatic hydrocarbons; sum of detected compounds

U = not detected at detection limit shown

J = estimated concentration

B = also detected in method blank

(59.0 vs 30.6 mg/Kg), lead (5.1 vs 0.5 mg/Kg), mercury (0.081 vs 0.017 mg/Kg), selenium (1.9 vs 0.8 mg/Kg), and silver (0.33 vs 0.02 mg/Kg). Of these metals, comparably elevated concentrations of chromium, copper, lead, and mercury occurred at several sites within Grays Harbor. The concentration of cadmium off Moon Island, selenium at Elliott Slough, and silver at Cosmopolis appeared to be substantially higher than in other parts of the harbor.

Organic Compounds - Table 9 shows the results of analysis for organic priority pollutants/HSL compounds. The types of compounds detected included volatiles, polycyclic aromatic hydrocarbons (PAH), phenols, several miscellaneous compounds (retene, dibenzofuran, and nitrosodiphenylamine), and phthalate acid esters (PAE)². Although the same compounds were generally detected in both of the replicate samples from the Weyerhaeuser outfall, concentrations of some PAH compounds and 4-methylphenol differed by more than a factor of two between replicates.

Three categories of organic priority pollutants--OC pesticides (1 ug/Kg detection limit), PCBs (10 ug/Kg detection limit), and 2,3,7,8-TCDD (0.68-0.85 ng/Kg detection limit)--were not detected in Grays Harbor sediments. Complete results from analysis for 2,3,7,8-TCDD and other PCDDs and PCDFs are presented later.

The organics data are summarized in the second part of Table 8. Volatile compounds (carbon disulfide, acetone, 2-butanone, methylene chloride, trichlorofluoromethane), phenol, and nitrosodiphenylamine were detected at only one or two sites. PAH, 4-methylphenol, retene, dibenzofuran, and PAE were commonly detected in the sediments. As previously described, significant contamination by phthalates and phenol was observed in methods blanks for this analysis. It should also be noted that nitrosodiphenylamine is occasionally encountered as a contaminant in methods blanks at the Manchester laboratory (Huntamer, 1989, personal communication).

The highest concentrations of organic compounds occurred near the pulp mill outfalls. Peak concentrations of total low molecular weight PAH (864 ug/Kg), total high molecular weight PAH (1700 ug/Kg), phenol (24B ug/Kg), 4-methylphenol (520 ug/Kg), dibenzofuran (31 ug/Kg), and nitrosodiphenylamine (12 ug/Kg) were measured in sediments collected at the Weyerhaeuser outfall. Sediments at the ITT outfall had the highest retene (540 ug/Kg) and PAE (510B - 610B ug/Kg) concentrations. An equally high retene concentration was measured in the Chehalis River at Cosmopolis. The Humptulips River Channel showed little evidence of contamination by these or other organic compounds, having only trace amounts of trichlorofluoromethane (7 ug/Kg) and PAE (20B - 57B ug/Kg) being detected.

Cyanide - Cyanide was not detected. Limits of detection ranged from 30 to 60 ug/Kg.

2Chemical structures for selected organic compounds are shown in Figure 2.

Table 9. Organic Priority Pollutants/Hazardous Substances List Compounds Detected in Grays Harbor Estuary Sediment Samples Collected May 23-24, 1988
 (ug/Kg, dry wt.; ppb)

Location:	Chehalis R. above Slough	Elliott near Mouth	Chehalis R. off Cow Point	S. Channel at Weyco Outfall	S. Channel bw. Weyco Outfall	S. Channel off Stearns Bluff	N. Channel at ITT Outfall	N. Channel off Moon Outfall	N. Channel off Moon Island	N. Channel R. Channel	N. Bay in Humpbacks R. Channel
Sample No. (22-):	8130	8131	8132	8133/55(a)	8134(b)	8136	8140	8137	8138	8139	8141
Volatile Organics:											
carbon disulfide	8 J	10 U	8 U	6 U	8 U	2 U	6 U	10 U	12 U	8 U	6 U
acetone	130	21 U	4 U	8 U	12 U	8 U	6 U	29 U	26 U	22 U	8 U
2-butaneone	21 B	5 BU	1 U	2 BU	3 BU	2 BU	1 BU	9 BU	7 BU	4 BU	1 BU
methylene chloride	22 BU	7 BU	77 B	4 BU	6 BU	7 BU	4 BU	5 BU	8 BU	7 BU	23 BU
trichlorofluoromethane	10 U	10 U	8 U	6 U	8 U	9 U	6 U	10 U	12 U	8 U	7
Low Molecular Weight PAH(c):											
naphthalene	17 BJ	53 BJ	34 BJ	44 BJ	110 B	87 BJ	71 BU	120 BU	28 BJ	20 BJ	75 BU
1-methylnaphthalene	120 U	130 U	100 U	20 J	91 U	100 U	71 U	120 U	130 U	92 U	75 U
2-methylnaphthalene	120 U	130 U	9 J	11 J	13 J	19 J	71 U	120 U	130 U	92 U	75 U
acenaphthylene	120 U	21 J	7 J	4 J	8 J	13 J	71 U	120 U	130 U	92 U	75 U
acenaphthene	120 U	130 U	100 U	30 J	71 J	26 J	71 U	120 U	130 U	92 U	75 U
fluorene	120 U	130 U	10 J	22 J	79 J	27 J	71 U	120 J	130 U	92 U	75 U
phenanthrene	30 J	110 J	51 J	120	530	120	71 U	110 J	120 J	92 U	75 U
anthracene	120 U	130 U	100 U	76 U	53 J	15 J	71 U	120 U	130 U	92 U	75 U
High Molecular Weight PAH:											
fluoranthene	78 J	170	57 J	98	840	88 J	71 U	120 J	110 J	59 J	75 U
pyrene	98 J	190	76 J	120	640	120	71 U	140	160	91 J	75 U
benzo(a)anthracene	120 U	130	16 J	21 J	91 J	23 J	71 U	120 U	130 U	92 U	75 U
chrysene	120 U	130 U	100 U	76 U	57 J	18 J	71 U	120 U	130 U	92 U	75 U
benzo(b)fluoranthene	120 U	110 J	100 U	20 J	39 J	100 U	71 U	120 U	130 U	92 U	75 U
benzo(k)fluoranthene	120 U	96 J	100 U	76 J	91 U	100 U	71 U	120 U	130 U	92 U	75 U
Phenols:											
phenol	120 BU	130 BU	16 BJ	76 BU	91 BU	24 BJ	71 BU	120 BU	130 BU	92 BU	75 BU
4-methylphenol	120 U	100 J	51 J	46 J	130	520	71 U	120 U	130 U	92 U	75 U
Miscellaneous Extractables:											
retene	540	510	110	64 J	120	150	71 U	370	540	240	75 U
dibenzofuran	120 U	130 U	100 U	19 J	31 J	21 J	71 U	17 J	21 J	92 U	75 U
N-nitrosodiphenylamine	120 U	130 U	100 U	76 U	91 U	12 J	71 U	120 U	130 U	92 U	75 U
Phthalates:											
di-n-butylphthalate	20 RJ	28 RJ	29 RJ	91 BU	35 BJ	71 BU	27 RJ	26 RJ	13 RJ	20 RJ	
di-n-octylphthalate	120 BU	77 RJ	15 RJ	46 RJ	91 BU	100 BU	71 BU	120 BU	510 B	92 BU	75 BU
bis(2-ethylhexyl)phthalate	410 B	72 RJ	97 RJ	300 B	82 RJ	46 RJ	95 B	170 B	610 B	69 RJ	57 RJ

(a) mean of duplicate analyses

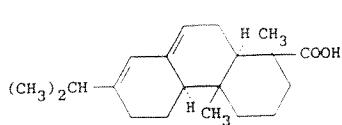
(b) replicate field sample

(c) polycyclic aromatic hydrocarbons; low molecular weight = 2-3 ring; high molecular weight = 4-6 ring

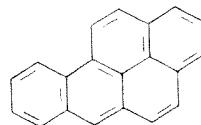
U = not detected at detection limit shown

J = estimated concentration

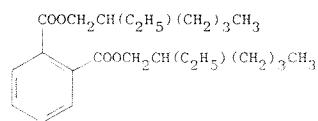
B = also detected in method blank



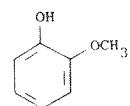
ABIETIC ACID



BENZO(a)PYRENE



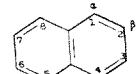
BIS(2-ETHYLHEXYL)PHTHALATE



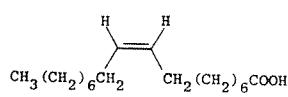
GUAIACOL



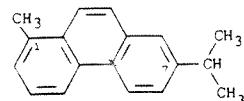
4-METHYLPHENOL



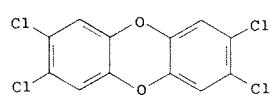
NAPHTHALENE



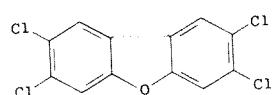
OLEIC ACID



RETENE



TCDD



TCDF

FIGURE 2. Structures of selected organic compounds detected by Ecology or others in Grays Harbor sediments (from The Merk Index).

Resin Acids, Guaiacols, Fatty Acids

Five resin acids (abietic, dehydroabietic, dichlorodehydroabietic, isopimaric, and sandaracopimaric), two guaiacols (guaiacol and 4,5,6-trichloroguaiacol), and two fatty acids (oleic and linoleic) were detected at one or more sites within the estuary (Table 10). Dehydroabietic, oleic, and linoleic acids were detected at all sites in Grays Harbor. The other compounds were detected at four or fewer sites. The only compound detected in North Bay was a trace amount of oleic acid (76 ug/Kg). Concentrations of resin and fatty acids detected in the field replicates agreed within a factor of 2 or less.

Resin acids were not consistently elevated at any one location (Table 11). The highest concentrations of individual resin acids occurred variously at the Weyerhaeuser outfall (abietic acid, 130 ug/Kg), Elliott Slough (dehydroabietic, dichlorodehydroabietic, and isopimaric acids, 80-980 ug/Kg), and Cosmopolis (sandaracopimaric acid, 92 ug/Kg). Guaiacols were detected only at the ITT outfall, and concentrations were low (9-19 ug/Kg). The highest fatty acid concentrations were measured at the ITT outfall (oleic acid, 3500 ug/Kg) and Elliott Slough (linoleic acid, 1500 ug/Kg).

Herbicides

Herbicides were not detected. Detection limits for the three target compounds in this analysis--atrazine, simazine, and pronamide--were 40-140 ug/Kg.

Polychlorinated Dioxins and Furans

PCDD and PCDF analysis was limited to three sediment samples, one each at the two pulp mill outfalls and one off Cow Point (Table 12). Tetra- through hexachlorodibenzodioxins (HxCDD) were not detected; detection limits ranged from 0.68-0.85 ng/Kg for TCDD to 3.7-11 ng/Kg for HxCDD. All samples contained comparable concentrations of 1,2,3,4,6,7,8-heptachlorodibenzodioxin (HpCDD, 11-18 ng/Kg), total HpCDD (25-42 ng/Kg) and total octachlorodibenzodioxin (OCDD, 92-140 ng/Kg).

The detection of PCDFs was restricted to 2,3,7,8-tetrachlorodibenzofuran (TCDF). Concentrations of 2.4 and 2.8 ng/Kg were measured at the ITT outfall and off Cow Point, respectively. TCDF was not detected at the Weyerhaeuser outfall.

Amphipod Bioassays

Short-term toxicity of the sediments collected in the vicinity of the pulp mill outfalls was assessed by bioassays with the amphipod *Rhepoxynius abronius*. The results are in Table 13. The survival rate of organisms exposed to outfall and Cow Point sediments for a period of 10 days was high (over 85%) and not significantly different from those exposed to laboratory control sediments. Avoidance and ability to rebury, which are indicators of sublethal effects, were similar for Grays Harbor and control sediments.

Table 10. Resin Acids, Guaiacols, and Fatty Acids Detected in Grays Harbor Estuary Sediment Samples Collected May 23 - 24, 1988 (ug/Kg, dry wt.; ppb)

Location:	Chehalis R. Elliott above Slough	Chehalis R. S. Channel off Cow Point	S. Channel @ Weyco	S. Channel off Stearns @ ITI	N. Channel bw. ITI	N. Channel off Moon	N. Bay in Humpnulips
Sample No. (22-):	8130	8131	8132	8133/35(a)	8134(b)	8136	8137
Resin Acids:							
abietic acid	80 J	120 U	100 U	29 J	66 J	130 J	71 U
dehydрабietic acid	830 B	980 B	250 BJ	160 BJ	260 BJ	400 BJ	16 RJ
dichlorodihydroabietic acid	70 J	80 J	100 U	76 U	91 U	100 U	71 U
isopimaric acid	150	210 J	100 U	76 U	91 U	100 U	71 U
sandaracopimaric acid	92 J	120 U	100 U	76 U	91 U	100 U	71 U
Guaiacols:							
guaiacol	120 U	120 U	100 U	76 U	91 U	100 U	71 U
4,5,6-trichloroguaiacol	120 U	120 U	100 U	76 U	91 U	100 U	71 U
Fatty Acids:							
oleic acid	950 J	2300 J	1500	960 J	740 J	800 J	83 J
linoleic acid	570	1600	630 J	170 J	440 J	540 J	8 J
						1600 J	1600 J
						740	740
						3500 J	3500 J
						1200 J	1200 J
						390	390
						75 U	75 U

(a) mean of duplicate analyses

(b) replicate field sample

U = not detected at detection limit shown

J = estimated concentration

B = also detected in method blank

Table 11. Summary of Occurrence of Resin Acids, Guaiacols, and Fatty Acids in Grays Harbor Estuary Sediment Samples Collected May 23-24, 1988 (ug/Kg dry wt.; ppb)

Chemical	Detection Frequency(a)	Concentration in Grays Harbor	Range	Concentration in North Bay	Location of Maximum
Resin Acids:					
abietic acid	4/10	29 J - 130 J	29 J - 130 J	75 U	Weyco Outfall
dehydroabietic acid	10/10	16 BJ - 980 B	16 BJ - 980 B	75 BU	Elliott Slough
dichlorodihydroabietic acid	3/10	70 J - 130 U	70 J - 130 U	75 U	Elliott Slough
isopimaric acid	4/10	61 J - 210 J	61 J - 210 J	75 U	Elliott Slough
sandaracopimaric acid	1/10	71 U - 92 J	71 U - 92 J	75 U	Cosmopolis
Guaiacols:					
guaiacol	1/10	19 J - 130 U	19 J - 130 U	75 U	ITT Outfall
4,5,6-trichloroguaiacol	1/10	9 J - 130 U	9 J - 130 U	75 U	ITT Outfall
Fatty Acids:					
oleic acid	10/10	83 J - 3500 J	83 J - 3500 J	76 J	ITT Outfall
linoleic acid	10/10	8 J - 1600 J	8 J - 1600 J	75 U	Elliott Slough

(a) number of samples where chemical detected/total number of samples analyzed

U = not detected at detection limit shown

J = estimated concentration

B = also detected in method blank

Table 12. Polychlorinated Dioxins/Furans Analysis of Selected Grays Harbor Estuary Sediment Samples Collected May 23, 1988
(ng/Kg, dry wt.; pptr)

Location:	Chehalis R. off Cow Point	S. Channel @ Weyco Outfall	N. Channel @ ITT Outfall
Sample No. (22-):	8132	8133	8137
Dioxins:			
TCDD (total)	0.85 U	0.68 U	0.79 U
2,3,7,8-TCDD	0.85 U	0.68 U	0.79 U
PeCDD (total)	8.6 U	4.0 U	8.1 U
1,2,3,7,8-PeCDD	8.6 U	4.0 U	8.1 U
HxCDD (total)	11 U	3.7 U	10 U
1,2,3,4,7,8-HxCDD	11 U	3.7 U	10 U
1,2,3,6,7,8-HxCDD	11 U	3.7 U	10 U
1,2,3,7,8,9-HxCDD	11 U	3.7 U	10 U
HxCDF (total)	42	25	32
1,2,3,4,6,7,8-HxCDF	18	11	15
OCDD (total)	140	120	92
Furans:			
TCDF (total)	2.8	0.63 U	2.4
2,3,7,8-TCDF	2.8	0.63 U	2.4
PeCDF (total)	9.4 U	1.5 U	4.1 U
1,2,3,7,8-PeCDF	9.4 U	1.5 U	4.1 U
2,3,4,7,8-PeCDF	9.4 U	1.5 U	4.1 U
HxCDF (total)	5.7 U	1.8 U	4.5 U
1,2,3,4,7,8-HxCDF	5.7 U	1.8 U	4.5 U
1,2,3,6,7,8-HxCDF	5.7 U	1.8 U	4.5 U
2,3,4,6,7,8-HxCDF	5.7 U	1.8 U	4.5 U
1,2,3,7,8,9-HxCDF	5.7 U	1.8 U	4.5 U
HxCDF (total)	7.7 U	3.5 U	5.0 U
1,2,3,4,6,7,8-HxCDF	7.7 U	3.5 U	5.0 U
1,2,3,4,7,8,9-HxCDF	7.7 U	3.5 U	5.0 U
OCDF (total)	21 U	14 U	12 U

U = not detected at detected limit shown

Table 13. Results of Amphipod Bioassays on Selected Grays Harbor Estuary Sediment Samples Collected May 23, 1988 (mean +/- standard deviation; 10-day exposure)

Location:	Chehalis R. off	S. Channel @ Weyco	S. Channel bw. Weyco	N. Channel @ ITT	N. Channel bw. ITT	Laboratory Control
Sample No. (22-):	Cow Point 8132	Outfall 8133	Outfall 8136	Outfall 8137	Outfall 8138	-
Survival(a)	18.6+/-1.1	19.4+/-0.9	18.6+/-0.5	18.8+/-1.3	17.2+/-1.1	18.8+/-1.6
Avoidance(b)	0.1+/-0.3	0.1+/-0.4	0.3+/-0.7	0.3+/-0.5	0.2+/-0.4	0.7+/-1.1
Percent Reburial(c)	98.9	100	100	98.9	98.9	100

(a) 5 replicates of 20 amphipods each; a value of 20 = 100 percent

(b) number of amphipods on the surface per replicate per day; 20 is maximum

(c) at end of test, percent of amphipods able to rebury in clean sediment after one hour

DISCUSSION

Comparison with Puget Sound

Table 14 summarizes the results of analysis for EPA priority pollutants and HSL compounds in Grays Harbor sediments and compares them to similar data for Puget Sound (Tetra Tech, 1986a, 1988a). As shown in the table, concentrations of all metals and many of the organic compounds detected in Grays Harbor are in the range of concentrations reported for reference sediments in parts of Puget Sound removed from urban bays and other sources of contamination. Chemicals that appear elevated in Grays Harbor relative to Puget Sound reference are PAH, 4-methylphenol, dibenzofuran, and retene in sediments at the Weyerhaeuser outfall; and retene, di-n-octylphthalate, and bis(2-ethylhexyl)phthalate at the ITT outfall, the two last-named compounds also being detected in method blanks. Retene was also elevated at Cosmopolis and Elliott Slough relative to reference areas.

One approach to assessing the significance of the level of chemical contamination observed in Grays Harbor sediments is by comparison with concentrations that appear to have potential for adverse biological effects in Puget Sound. Tetra Tech (1988b) reports Apparent Effects Threshold (AET) values for a wide range of chemicals in Puget Sound sediments. An AET is defined as the sediment concentration of a chemical above which a statistically significant biological effect (relative to reference sediments) is always observed. The biological indicators used in deriving these effects thresholds are depressions in benthic infauna, and results of amphipod (*Rhepoxynius abronius*), oyster larvae (*Crassostrea gigas*), and Microtox(R) bioassays.

Table 14 lists the lowest and highest Puget Sound AET values--calculated from results for up to 287 stations--for those priority pollutants and HSL compounds detected in Grays Harbor. Metals concentrations measured in Grays Harbor sediments are substantially less than the lowest Puget Sound AETs. Concentrations of organic priority pollutants and HSL compounds in Grays Harbor sediments are also low relative to AETs, except for 4-methylphenol in one of the Weyerhaeuser outfall samples (520 ug/Kg vs an AET of 670 ug/Kg) and di-n-octyl phthalate in the ITT outfall sample (510B ug/Kg vs an AET of 420 ug/Kg) which approach or may approach the lowest AET values.

Resin Acid/Guaiacol Concentrations Near Other Pulp Mills

Resin acids, guaiacols, and fatty acids are naturally occurring compounds, but are much concentrated in pulp mill effluents (Keith, 1976; Oikari and Holmbom, 1986). Chlorinated resin acids and guaiacols are unique tracers of effluents from pulp mills like those in Grays Harbor which bleach pulp with chlorine. The biological significance of the presence of these compounds in marine or freshwater sediments is not known.

The available data on resin acid and guaiacol concentrations in sediments from Puget Sound reference areas and near pulp mill outfalls in Puget Sound and the Columbia River are summarized in Table 15. Similar data were not found for fatty acids. Resin acid and guaiacol concentrations measured in Grays Harbor sediments are lower than those reported for

Table 14. Priority Pollutants/ Hazardous Substances List Compounds Detected in Grays Harbor Sediment Samples Compared to Puget Sound Reference Areas and Apparent Effects Threshold (AET) Values
 (metals in mg/Kg, dry wt.; ppm -- organics in ug/Kg, dry wt.; ppb)

Chemical	Grays Harbor:			Puget Sound Reference Areas(a):			Puget Sound AET Values(b):		
	Detection Frequency(c)	Concentration Range	Detection Frequency	Concentration Range	Reference Area	Lowest AET	Highest AET	Reference Area	Lowest AET
Metals:									
arsenic	10/10	3.4 -	4.8	38/38	1.9 -	17	57	700	-
beryllium	10/10	0.7 -	1.1	-	-	-	-	-	-
cadmium	1/10	0.5 U	0.9	28/28	0.1 -	1.9	5.1	9.6	-
chromium	10/10	16.3 -	35.0	42/42	9.6 -	255	260	270	1300
copper	10/10	19.3 -	59.0	32/32	5 -	74	390	660	660
lead	8/10	0.5 U	5.1	25/32	0.1 U -	24	450	2.1	-
mercury	10/10	0.014 -	0.081	42/42	0.01 -	0.28	0.41	>140	>140
nickel	10/10	45.7 -	64.0	30/30	4 -	140	-	-	-
selenium	10/10	0.1 -	1.9	18/28	0.1 U -	1.0	-	-	-
silver	3/10	0.02 U -	0.33	28/30	0.02 U -	3.3	0.56	>6.1	-
zinc	10/10	51.6 -	80.8	30/30	15 -	102	410	1600	-
Volatile Organics:									
carbon disulfide	1/10	2 U -	8 J	0/10	-	-	-	-	-
acetone	1/10	4 U -	130	0/10	-	-	-	-	-
2-butaneone	1/10	1 BU -	21 B	0/10	-	-	-	-	-
methylene chloride	1/10	4 BU -	77 B	0/10	-	-	-	-	-
Total PAH(d):									
low molecular weight PAH	9/10	20 BJ -	860 J	10/25	2.5 -	170	5200	24000	-
high molecular weight PAH	9/10	71 U -	1700 J	12/15	22 -	217	12000	69000	-
Phenols:									
phenol	2/10	16 BJ -	24 BJ	8/20	3.3 U -	62	420	1200	-
4-methylphenol	6/10	46 J -	520	7/11	2 U -	290	670	3600	-
Miscellaneous Extractables:									
retene	9/10	64 J -	540	8/13	0 -	130 J	-	-	-
dibenzofuran	5/10	19 J -	31 J	4/11	5 U -	14	540	1700	-
n-nitrosodiphenylamine	1/10	71 U -	12 J	0/8	0.5 U -	10 U	28	130	-
Phthalates:									
di-n-butylphthalate	8/10	13 BJ -	35 BJ	6/8	20 U -	760	1400	>5100	-
di-n-octylphthalate	4/10	15 BJ -	510 B	5/12	0.5 U -	56 U	>420	6200	-
bis(2-ethylhexyl)phthalate	10/10	46 BJ -	610 B	3/8	0.5 U -	58	1300	>1100	-

(a) Tetra Tech (1986a, 1988a)

(b) Tetra Tech(1988a)

(c) number of samples where chemical detected/total number of samples analyzed

(d) polycyclic aromatic hydrocarbons

U = not detected at detection limit shown

J = estimated concentration

Table 15. Concentrations of Resin Acids and Guaiacols Detected in Grays Harbor Sediments Compared to Puget Sound Reference Areas Sediments and Sediments Near Other Northwest Pulp Mills (concentration range in ug/Kg, dry wt.; ppb)

Chemical	Grays Harbor	Puget Sound Reference Areas(a) (n=14)			Sediments Near Northwest Pulp Mills:		
		Everett Harbor, East Waterway(a) (n=14)	Port Gardner(a) (n=5)	Other Harbor, Port Townsend Bay(b) (n=3)	Columbia River @ Camas Vancouver & Longview(c) (n=3)		
Resin Acids:							
abietic acid	29 J - 130 J	130 U - 180 U	590 - 98000	280 J - 1700	160 J - 4400	110 - 500	
dehydroabietic acid	16 BJ - 980 B	20 J - 130 U	1200 - 83000	560 - 1500	230 J - 33000	240 - 920	
dichlorodehydroabietic acid	70 J - 80 J	130 U - 180 U	170 J - 900 U	140 U - 240 U	270 U - 450 U	42 J - 300 U	
isopimaric acid	61 J - 210 J	130 U - 180 U	330 J - 6200	85 J - 350 J	200 U - 1700	130 - 500	
sandaracopimaric acid	71 U - 92 J	130 U - 180 U	200 J - 8800	43 J - 110 J	21 J - 970	32 J - 130 J	
12-chlorodehydroabietic acid	NA	130 U - 180 U	200 J - 11000	78 J - 270 J	NA	NA	
14-chlorodehydroabietic acid	NA	130 U - 180 U	220 U - 14000	46 J - 190 U	NA	NA	
neoabietic acid	NA	130 U - 180 U	79 J - 140000 J	220 U - 3400	NA	NA	
levopimaric acid	NA	NA	NA	NA	270 U - 450 U	100 U - 300 U	
palustric acid	NA	NA	NA	NA	270 U - 450 U	100 U - 300 U	
Guaiacols:							
guaiacol	19 J - 130 U	NA	4 U - 48	NA	200 U - 450 U	100 U - 300 U	
4,5,6-trichloroguaiacol	9 J - 130 U	3 U (all)	4 U - 110	4 U (all)	200 U - 450 U	100 U - 300 U	
3,4,5-trichloroguaiacol	NA	3 U (all)	4 U - 50	4 U (all)	NA	NA	
tetrachloroguaiacol	71 U - 130 U	3 U (all)	4 U - 50	4 U (all)	200 U - 450 U	100 U - 300 U	

(a) Tetra Tech (1988b)

(b) Johnson (1988)

(c) Johnson and Norton (1988)

U = not detected at detection limit shown

J = estimated concentration

NA = not analyzed

sediments near Puget Sound mills. The few analyses done to date show reference area concentrations of resin acids and guaiacols in Puget Sound to be less than 130-180 ug/Kg and 3 ug/Kg, respectively. Sediments collected near outfalls from Everett and Port Townsend mills have had resin acid concentrations in the range of thousands to tens- of-thousands of ug/Kg; guaiacol concentrations were much lower, maximum concentrations being 48-110 ug/Kg in Everett Harbor's East Waterway. The concentrations of resin acids and guaiacols in Grays Harbor sediments appear relatively low and are similar to those measured downstream of Columbia River pulp mills.

Detection of Dioxins and Furans in Grays Harbor Sediments

Sediments collected near Grays Harbor pulp mill outfalls contained trace amounts (2.4-140 ng/Kg) of HpCDD, OCDD, and TCDF. Similar analysis of an ITT sludge sample collected during Ecology's recent Class II inspection (Reif, 1989) also detected OCDD (59 ng/Kg) and 2,3,7,8-TCDF (3.5 ng/Kg). Weyerhaeuser sludge was not analyzed for PCDDs or PCDFs during the companion Class II at that facility (Hallinan, 1989).

EPA obtained additional data on 2,3,7,8-TCDD concentrations in Grays Harbor during 1988 (Hornig 1988, unpublished data). One sediment sample at each of the pulp mill outfalls, and suspended matter samples collected from mill effluents and the inner harbor water column were analyzed. In contrast to present survey findings, EPA detected 2,3,7,8-TCDD in bottom sediments at both the Weyerhaeuser (1.3 ng/Kg) and ITT (3.5 ng/Kg) outfalls. 2,3,7,8-TCDD was also detected in suspended matter from the North (1.53 ng/Kg) and South (2.00 ng/Kg) Chehalis River Channels and in suspended matter from Weyerhaeuser's final effluent (4.42 ng/Kg). 2,3,7,8-TCDD was not detected in suspended matter samples from the Chehalis River reach between the Wishkah River mouth and Cosmopolis (7.11 ng/Kg detection limit), or in suspended matter from ITT effluent (0.658 ng/Kg detection limit). (See Appendix C for a discussion of other chemicals detected in suspended matter.)

The significance of trace contamination of sediments by PCDDs and PCDFs is unknown. Comparable 2,3,7,8-TCDD concentrations have been measured by EPA in the lower Columbia River (unpublished data from the National Dioxin Study). Four sediment samples analyzed from Columbia Slough, Portland, Oregon, had 2,3,7,8-TCDD concentrations ranging from less than 1.05 ng/Kg to 4.51 ng/Kg. Other PCDDs and PCDFs were not analyzed.

Most of the data presently available on PCDDs and PCDFs in waters of the Pacific Northwest are from analysis of fish tissue by EPA (unpublished data from the National Bioaccumulation Program) and Environment Canada (Mah *et al.*, 1989, and unpublished data from National Dioxin/Furan Fish Sampling Program). Data on 2,3,7,8-TCDD and 2,3,7,8-TCDF, which are the predominant compounds in the whole fish and fillet samples analyzed, are summarized in Table 16. The Grays Harbor data are limited to one composite whole fish sample each from the North and South Chehalis River Channels below the pulp mill outfalls. The species analyzed was starry flounder (*Platichthys stellatus*). South Channel fish contained 0.45 ng/Kg TCDD and 9.06 ng/Kg TCDF; TCDD and TCDF were not detected in the North Channel fish. Not included in Table 16 are two EPA samples of soft-shell clams (*Mya arenaria*) also collected

Table 16. Summary of EPA and Environment Canada Data on TCDD and TCDF Concentrations in Pacific Northwest Fish (ng/kg, wet wt.; pptr)

Location	No. of Sampling Sites	No. of Samples Analyzed	Concentrations		
			2, 3, 7, 8-TCDD Median (range)	2, 3, 7, 8-TCDF Median (range)	2, 3, 7, 8-TCDF Median (range)
Washington/Oregon:					
Grays Harbor bw pulp mills	2	2	- (1.01U - 0.45)	-	(0.49 U - 9.06)
Columbia River between Tri-Cities and Portland	7	18	2.07(0.88 - 56.02)	20.12(4.1 - 320)	
Puget Sound	5	8	1.54(1.02U - 5.04)	6.4 (0.94 - 145.88)	
Other Washington Rivers	3	5	0.37(0.37 - 0.79)	0.99(0.36 U - 9.14)	
British Columbia:					
Thompson River bw pulp mill	1	3	59.9(12.5 - 60.9)	387 (16.0 - 704)	
Frazer River bw pulp mills	2	7	12.4 (2.9 - 137)	156 (15.8 - 1185)	
Columbia River bw pulp mill	1	3	6.6 (2 U - 10.5)	647 (25.8 - 908)	
Other B.C. Rivers bw pulp mills	4	12	2.0 (2 U - 4.6)	40.6 (6.2 - 80.1)	
B.C. Rivers abv pulp mills	6	18	2 U (2 U - 25.3)	9.4 (2 U - 392)	
Marine waters near pulp mills	3	7	2.0 (1.6 - 11)	11 (5.1 - 28)	

U = not detected at detection limit shown

Note: Samples are whole fish and fillets; see text for data sources.

below the mills. These had only 2,3,7,8-TCDF detectable--13.08 ng/Kg for the South Channel and 1.9 ng/Kg for the North Channel.

The limited data presently available for Grays Harbor suggest the level of dioxin and furan contamination is similar to or less than many other sites in Washington, Oregon, and British Columbia. The sediment concentrations associated with high TCDD and TCDF concentrations evident in fish below British Columbia pulp mills (Table 16) were in the range of 100-3168 ng/Kg for 2,3,7,8-TCDF--two to three orders of magnitude higher than measured in sediment or suspended matter samples collected in Grays Harbor. 2,3,7,8-TCDD was not detected in British Columbia sediments, this apparently due to a higher detection limit (15 ng/Kg) than in Washington and Oregon samples. HpCDD and OCDD, the predominant dioxins in the Grays Harbor sediment samples, were also not quantified in British Columbia sediments, again a probable reflection of elevated limits of detection (50-75 ng/Kg). It should be noted that British Columbia pulp mills have a much lower level of effluent treatment required than mills in Washington and Oregon.

Sources of PCDDs and PCDFs include, but are not limited to, effluents from pulp mills using chlorine as a bleaching agent (Konasewich *et al.*, 1982; Eisler, 1986). Other sources are as trace impurities in PCBs, and commercial herbicides and chlorinated phenols (2,4-D, 2,4,5-T, trichlorophenol, pentachlorophenol). PCDDs and PCDFs are also created during combustion at municipal and industrial incinerators. 2,3,7,8-TCDF is considered to be one-tenth as toxic as 2,3,7,8-TCDD. For both PCDDs and PCDFs, toxicity decreases markedly with increasing chlorine substitution. For example, 1,2,3,4,6,7,8-HpCDD is estimated to be one thousand times less toxic than 2,3,7,8-TCDD (Bellin and Barnes, 1986). FDA health advisory limits for 2,3,7,8-TCDD in edible fish tissues are in the range 25-50 ng/Kg (FDA, 1981); lower limits of 10 ng/Kg and 20 ng/Kg have been adopted by New York and Canada, respectively (Kleopfer and Zirschky, 1983).

Comparison with Previous Sediment Surveys in Grays Harbor

Results from previous surveys of chemical contaminants in Grays Harbor sediments are in agreement with those of the present study, namely that the level of contamination is low. The Army Corps of Engineers conducted a survey in 1980-81 sampling 14 stations from Cosmopolis, down the North Chehalis River Channel and out to the harbor entrance at Westport. The majority of chemical analyses were conducted on elutriates (harbor water contacted with sediment samples in the laboratory to mimic dredge disposal operations) rather than bulk sediment. Their report (Am Test, Inc. and Environmental Resources Section, 1981) concluded "concentrations of the majority of contaminants found in Grays Harbor sediments were very low." The principal finding of interest was detection of PCBs at four sampling sites--Cosmopolis, near Cow Point, off Moon Island, and an outer harbor station--in the range of 17 - 390 ug/Kg.

The potential for sediment toxicity and bioaccumulation of chemicals associated with the sediments was assessed by the University of Washington for three sites in the North Chehalis River Channel between Rennie and Moon Islands (Pierson *et al.*, 1983). The sediments were not toxic to Dungeness crab (*Cancer magister*), an amphipod (*Grandifoxus grandis*), or chum

salmon (*Oncorhynchus keta*). Trace amounts of phthalates (3.4-200 ug/Kg, wet weight), benzene hexachloride (0.02-5 ug/Kg or less, wet weight), and aldrin (0.8-1.5 ug/Kg, wet weight) were measured in the sediments. PCBs were not detected, and metals concentrations in the sediments were low. Because some bioaccumulation of phthalates was observed during 30-day exposure of chum salmon, sand sole (*Psettichthys melanostictus*), and lugworms (*Abarenicola pacifica*), and because of inconclusive evidence of mortality among clams exposed to Rennie Island sediments during the bioaccumulation experiments, the investigators considered the middle and upper channel sites "suspect" and recommended additional chemical and biological tests.

NOAA conducted a further investigation into the bioaccumulation potential of Grays Harbor sediments (Brown *et al.*, 1984). Ten sites between Cosmopolis and the middle North Channel were evaluated. Their analysis showed the sediments contained "very low concentrations" of aromatic hydrocarbons, chlorinated hydrocarbons, and phthalates. Except for two naturally occurring aromatic hydrocarbons--perylene and retene--chemical concentrations were considered to be comparable to those in Puget Sound reference area sediments. Concentrations of chlorinated pesticides, PCBs, phthalates were near or below detection limits. The highest phthalate concentrations measured were for bis(2-ethylhexyl)phthalate and dibutylphthalate in the range of 20-50 ug/Kg, wet weight. Significant accumulation of the above chemicals was not found in clams (*Macoma baltica*) or amphipods (species not identified).

The Army Corps of Engineers also investigated possible impairment of the osmoregulatory capacity of smolting coho salmon due to exposure to bottom sediments during dredging operations (Kehoe, 1982a). Seawater challenges after a nine-day exposure to North Channel sediments showed no increase in blood sodium levels, indicating normal ability to make the transition from freshwater to seawater.

In 1986 the Port of Grays Harbor analyzed metals, semivolatiles, OC pesticides, and PCBs in sediments collected off Terminals #2 and #4 along the North Chehalis River Channel (Lattin, 1986). Metals concentrations were low. The sediments had trace amounts (less than 100 ug/Kg) of PAH and phthalates. Pesticides and PCBs were not detected. Amphipod bioassays (*Rhepoxynius abronius*) showed survival was high and comparable to laboratory control sediments.

Most recently, Battelle analyzed sediments from Elliott Slough, Cow Point, and the Hoquiam and Moon Island reaches of the North Channel for metals, total volatile solids, oil and grease, and total organic carbon (Word, 1987). They concluded the sediments were suitable for unconfined open-water disposal.

CONCLUSIONS

The results of Ecology's 1988 survey of chemical contaminants in Grays Harbor bottom sediments support and expand the data from previous surveys of the estuary that have shown the level of chemical contamination to be relatively low. This may stem from factors other than an absence of sources, including dilution by the high rate of suspended sediment discharge from the Chehalis River drainage (Kehoe, 1982b), seaward transport of contaminants by the river, and removal of sediment accumulations through routine dredging of the inner harbor. This consideration is prompted, in part, by the disparity between resin acid concentrations in Grays Harbor sediments and those near pulp mills in Puget Sound, as discussed elsewhere in this report. Detection of only trace amounts of these and other compounds present in pulp mill effluent in spite of discharges on the order of 50 million gallons per day suggests that the quality of the bottom sediments is not broadly applicable as an index of Grays Harbor water quality. On the other hand, preliminary results from analysis of EPA suspended matter samples (discussed in Appendix C) are in many ways consistent with results from sediment surveys and suggest current inputs of a number of contaminants frequently considered a concern in other water bodies--metals, OC pesticides, and PCBs, for example--may not be a significant problem in Grays Harbor estuary.

Implications of these results for the salmon survival problem currently under study are unclear. Surveys by several different investigators analyzing a wide range of chemicals have failed to find high concentrations or detect the presence of unusual compounds in Grays Harbor sediments. If water quality is ultimately found to be contributing to poor salmon survival, it may be due to: a chemical(s) with low potential for absorption to particulates and/or not amenable to commonly employed methods of analysis; constituents or concentrations not generally recognized as a water quality concern; or, perhaps, unanticipated interactions between chemicals.

ACKNOWLEDGMENTS

The sediment samples for this survey were collected by Dale Norton, Pat Hallinan, Don Reif, and Carlos Ruiz of Ecology. Chemical analysis of these samples was part of an exceptional work load for the Ecology/EPA Manchester laboratory generated by the Grays Harbor salmon survival study. The work of the chemists and support staff is very much appreciated. The manuscript was typed by Sonya Kirkendall, Pam Berns, and Carol Perez.

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APPENDIX A

Work Conducted by Ecology during the Grays Harbor Salmon Survival Study

Appendix A. Work Conducted by Ecology during the Grays Harbor Salmon Survival Study

Description	Date	Reference
1. Chemical analysis of wastewater for pilot coho smolt bioassay	4/30 - 5/04/87	Joy (1988)
2. Urban storm drain inventory for inner Grays Harbor	7/17-29/87	Pelletier and Determan (1988)
3. Ceriodaphnia bioassays of Chehalis and Humpatulips Rivers (analysis by EPA)	2/17/87 2/02/88	Michaud (1989)
4. Chemical survey of Grays Harbor estuary bottom sediments	5/23-24/88	present study
5. Class II inspections* of Weyerhaeuser and ITT pulp mills	5/23-25/88	Hallinan (1989) Reif (1989)
6. Conventional water quality monitoring during coho smolt bioassays and barging experiments	5/31 - 6/7/88	Coots (1988a and b)
7. Study of variability in toxicity and chemistry of Weyerhaeuser and ITT pulp mill effluents	3/7 - 6/20/89	report in preparation
8. Technical assistance to EPA in collecting suspended matter samples from pulp mill effluents and Grays Harbor water column	4/21 - 5/19/89	**

* Class II inspections assess wastewater treatment efficiency, determine compliance with effluent discharge permit limits, review laboratory procedures at the facility, and obtain data on chemical characteristics and toxicity of effluents and receiving environment.

** Technical assistance provided by Carlos Ruiz, Compliance Monitoring Section.

APPENDIX B

Data Set

Project: DOE-541F GRAYS HARBOR SALMON SURVEY

Laboratory: Ecology, Manchester

Sample No: 88 228130

Description: AB COSMOP

Begin Date: 88/05/23 :

Gen Inorg/Phys-Speci		Sediment		VOA - PP Scan (GCMS)		Sediment		VOA - PP Scan (GCMS)		Sediment	
Cyanide	Sedmt	Result	Units	Result	Units	Result	Units	Result	Units	Result	Units
Metals - PP		0.04U	mg/kg-dr	1,1-Dichloroethane	10U	ug/kg		2,2-Dichloropropane	10U	ug/kg	
				1,1-Dichloroethene	10U	ug/kg		2-Hexanone	20U	ug/kg	
				Trichlorofluoromethane	10U	ug/kg		Ethane, 1,1,1,2-Tetrac+	10U	ug/kg	
				Methane, Dichlorodiflu+	20U	ug/kg		cis-1,3-Dichloropropene	10U	ug/kg	
				Dichloropropane	10U	ug/kg		trans-1,3-Dichloroprop+	10U	ug/kg	
				1,2-Dichloropropane	21B*	ug/kg		Surrog: D4-1,2-Dichlor+	91%	% Recov	
				2-Butanone	10U	ug/kg		Surrog: 1,4-Bromofluor+	75%	% Recov	
				1,1,2-Trichloroethane	10U	ug/kg		Surrog: 1,4-Bromofluor+	75%	% Recov	
				Trichloroethene	10U	ug/kg		Surrog: D8-Toluene	107%	% Recov	
				1,1,2,2-Tetrachloroeth+	10U	ug/kg					
				1,1,2,3-Trichlorobenzene	10U	ug/kg					
				Hexachlorobutadiene	10U	ug/kg					
				Naphthalene	10U	ug/kg					
				Total Xylenes	10U	ug/kg					
				2-Chlorotoluene	10U	ug/kg		Benzo(a)pyrene	120U	ug/kg	
				1,2-Dichlorobenzene	10U	ug/kg		2,4-Dinitrophenol	590U	ug/kg	
				1,2,4-Trimethylbenzene	10U	ug/kg		Dibenzo(a,h)anthracene	120U	ug/kg	
				DBCP	10U	ug/kg		Benzo(a)anthracene	120U	ug/kg	
				1,2,3-Trichloropropane	10U	ug/kg		4-Chloro-3-MethylPhenol	120U	ug/kg	
				Tert-Butylbenzene	10U	ug/kg		Benzoic acid	590U	ug/kg	
				Isopropylbenzene (Cum+	10U	ug/kg		Hexachloroethane	120U	ug/kg	
				p-Isopropyltoluene	10U	ug/kg		Hexachlorocyclopentadi+	240U	ug/kg	
				Styrene	10U	ug/kg		Isophorone	120U	ug/kg	
				5. * mg/kg-dr	10U	ug/kg		Acenaphthene	120U	ug/kg	
				Styrene	10U	ug/kg		Diethylphthalate	120BU	ug/kg	
				57. * mg/kg-dr	10U	ug/kg		Di-n-Butylphthalate	20BJ*	ug/kg	
				Benzene, Propyl-	10U	ug/kg		Phenanthrene	30J*	ug/kg	
				Butylbenzene	10U	ug/kg		Butylbenzylphthalate	120BU	ug/kg	
				4-Chlorotoluene	10U	ug/kg		N-Nitrosodiphenylamine	120U	ug/kg	
				1,4-Dichlorobenzene	10U	ug/kg		Fluorene	120U	ug/kg	
				1,2-Dibromoethane (EDB)	10U	ug/kg		Carbazole	120U	ug/kg	
				1,2-Dichloroethane	10U	ug/kg		Hexachlorobutadiene	120U	ug/kg	
				Vinyl Acetate	20U	ug/kg		Pentachlorophenol	590U	ug/kg	
				1,3,5-Trimethylbenzene	10U	ug/kg		2,4,6-Trichlorophenol	120U	ug/kg	
				Bromobenzene	10U	ug/kg		2-Nitrophenol	590U	ug/kg	
				Toluene	10U	ug/kg		2-Nitrophenol	120U	ug/kg	
				Chlorobenzene	10U	ug/kg		Naphthalene, 1-Methyl-	120U	ug/kg	
				1,2,4-Trichlorobenzene	20U	ug/kg		Chloromethane	120U	ug/kg	
				Dibromochloromethane	20U	ug/kg		2-Methylnaphthalene	120U	ug/kg	
				Tetrachloroethene	10U	ug/kg		2-Chloronaphthalene	120U	ug/kg	
				Sec-Butylbenzene	20U	ug/kg		3,3'-Dichlorobenzidine	120U	ug/kg	
				1,3-Dichloropropane	20U	ug/kg		2-MethylPhenol	120U	ug/kg	
				Cis-1,2-Dichloroethene	22U	ug/kg		1,2-Dichlorobenzene	120U	ug/kg	
				trans-1,2-Dichloroethene	8.1J*	ug/kg		1,2-Dichlorobenzene	120U	ug/kg	
				1,3-Dichlorobenzene	10U	ug/kg		o-Chlorophenol	120U	ug/kg	
				1,1-Dichloropropane	10U	ug/kg		2,4,5-Trichlorophenol	590U	ug/kg	

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Project: DOE-541F GRAYS HARBOR SALMON SURVEY

Officer: DXR Account: 41652

Laboratory: Ecology, Manchester

Sample No: 88 228130 Description: AB COSMOP

Begin Date: 88/05/23 :

B/N/Acid Scan *** Continue	Sediment Result	Units	Resin Acids Guaiacol	Sediment Result	Units	Pest/PCB - PP Scan	Sediment Result	Units
Nitrobenzene	120U	ug/kg	Guaiacol (2-methoxyphen+ 4-Allylguaiacol (eugen+ Oleic acid	120U	ug/kg	4, 4'-DDT Chlordane	1U	ug/kg
3-Nitroaniline	590U	ug/kg	Sandarac/pimamic acid	120U	ug/kg	gamma-BHC (Lindane)	1U	ug/kg
4-Nitroaniline	590U	ug/kg	Abietic acid	950J*	ug/kg	Dieldrin	1U	ug/kg
4-Nitropheno1	590U	ug/kg	Tetrachloroguaiacol	92J*	ug/kg	Endrin	1U	ug/kg
Benzyl Alcohol	120U	ug/kg	4, 5, 6-Trichloroguaic acid	80J*	ug/kg	4, 4'-DDD	1U	ug/kg
4-Bromophenyl-phenylet+	120U	ug/kg	9, 10-Dichlorosteric ac+	120U	ug/kg	4, 4'-DDE	1U	ug/kg
2, 4-Dimethylphenol	120U	ug/kg	Dichlorodehydroabietic+	70J*	ug/kg	Heptachlor	1U	ug/kg
4-Methylphenol	120U	ug/kg	Dehydroabietic acid	830B*	ug/kg	Aldrin	1U	ug/kg
1, 4-Dichlorobenzene	120U	ug/kg	4, 5-Dichloroguaiacol	120U	ug/kg	alpha-BHC	1U	ug/kg
4-Chloroaniline	120BU	ug/kg	4, 5-Dichlororosyringol	120U	ug/kg	beta-BHC	1U	ug/kg
Phenol	120U	ug/kg	Isopimaric acid	150 *	ug/kg	delta-BHC	1U	ug/kg
bis(2-Chloroethoxy)Ether	120U	ug/kg	4-Chloroguaiacol	120U	ug/kg	alpha-Endosulfan	1U	ug/kg
BIS(2-ETHYLHEXYL) PHTH+	72BJ*	ug/kg	Surrog: Pyrene D10	190 *	% Recov	Heptachlor epoxide	1U	ug/kg
Di-n-Octyl Phthalate	120BU	ug/kg	Surrog: 2-Fluorobiphen+	29 *	% Recov	Endosulfan sulfate	1U	ug/kg
Hexachlorobenzene	120U	ug/kg	Surrog: 2-Fluorophenol	71	% Recov	Endrin aldehyde	1U	ug/kg
Anthracene	120U	ug/kg	Surrog: Heptadecanoic +	42 *	% Recov	Toxaphene	30U	ug/kg
1, 2, 4-Trichlorobenzene	120U	ug/kg	Surrog: D14-Terphenyl	51	% Recov	PCB - 1260	10U	ug/kg
2, 4-Dichlorophenol	120U	ug/kg	Surrog: 2-Naphthoic ac+	51	% Recov	PCB - 1254	10U	ug/kg
2, 4-Dinitrotoluene	120U	ug/kg	Surrog: D5-Nitrobenzene	32 *	% Recov	PCB - 1221	10U	ug/kg
Pyrene	98J*	ug/kg	Surrog: D5-Phenol	47 *	% Recov	PCB - 1232	10U	ug/kg
Dimethylphthalate	120U	ug/kg	Surrog: o-Methylpodoca+	78	% Recov	PCB - 1248	10U	ug/kg
Dibenzofuran	120U	ug/kg	+ Intstd: Hexabromobenzene			PCB - 1016	10U	ug/kg
Benz(ghi)perylene	120U	ug/kg	+ Intstd: Hexabromobenzene			PCB - 1242	10U	ug/kg
Indeno(1, 2, 3-cd)pyrene	120U	ug/kg	+ % Recov			PCB - 1242	10U	ug/kg
Benzo(b)fluoranthene	120U	ug/kg	+ Misc GC Specified			Intstd: Hexabromobenzene	98%	% Recov
Fluoranthene	78J*	ug/kg	+ Result			+ Intstd: Hexabromobenzene		
Benzo(k)fluoranthene	120U	ug/kg	+ Aldicarb			+ Pest/PCB - PP Scan		
Acenaphthylene	120U	ug/kg	+ Simazine			+ Matrix Spike #1		
Chrysene	120U	ug/kg	+ Diuron			+ Result		
Retene	540 *	ug/kg	+ Atrazine			+ Units		
4, 6-Dinitro-2-methylph+	590U	ug/kg	+ Butylate			+ Sediment		
1, 3-Dichlorobenzene	120U	ug/kg	+ Metribuzin			+ Result		
2, 6-Dinitrotoluene	120U	ug/kg	+ Fenamiphos			+ Units		
N-Nitroso-di-n-Propyl-	120U	ug/kg	+ Pronamide			+ Sediment		
4-Chlorophenyl-phenyle+	120U	ug/kg	+ Hexazinone			+ Result		
bis(2-Chloroisopropyl)+	120U	ug/kg	+ Recov			+ Units		
Surrog: D10-Pyrene	94%	%	+ Recov			+ Sediment		
Surrog: 2-Fluorobiphen+	46%	%	+ Recov			+ Result		
Surrog: 2-Fluorophenol	38%	%	+ Recov			+ Units		
Surrog: D14-Terphenyl	103%	%	+ Recov			+ Sediment		
Surrog: D5-Nitrobenzene	32%	%	+ Recov			+ Result		
Surrog: D5-Phenol	38%	%	+ Recov			+ Units		

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Washington State Department of Ecology
Sample/Project Analysis Results

Project: DOE-541F GRAYS HARBOR SALMON SURVEY

Laboratory: Ecology, Manchester

Sample No: 88 228130

Description: AB COSMOP

Begin Date: 88/05/23 :

Pest/PCB	PP Scan	Sediment		Pest/PCB	PP Scan	Sediment	
***	Continued	***		***	Continued	***	
Matrix Spike #1	Result	Units		Matrix Spike #2	Result	Units	
delta-BHC	8U	ug/kg		PCB - 1221	80U	ug/kg	
alpha-Endosulfan	8U	ug/kg		PCB - 1232	80U	ug/kg	
Heptachlor epoxide	8U	ug/kg		PCB - 1248	80U	ug/kg	
Endosulfan sulfate	8U	ug/kg		PCB - 1016	80U	ug/kg	
Endrin aldehyde	8U	ug/kg		beta-Endosulfan	8U	ug/kg	
Toxaphene	240U	ug/kg		PCB - 1242	80U	ug/kg	
PCB - 1260	8U	ug/kg		IntStd: o,p'-DDE	SPIKE	% Recov	
PCB - 1254	8U	ug/kg		IntStd: Hexabromobenzene	76%	% Recov	
PCB - 1221	8U	ug/kg		IntStd: Tetrabromobenzene	NAR	% Recov	
PCB - 1232	8U	ug/kg					
PCB - 1248	8U	ug/kg					
PCB - 1016	8U	ug/kg					
beta-Endosulfan	8U	ug/kg					
PCB - 1242	8U	ug/kg					
IntStd: o,p'-DDE	SPIKE	% Recov					
IntStd: Hexabromobenzene	83%	% Recov					
IntStd: Tetrabromobenzene	NAR	% Recov					

Pest/PCB	PP Scan	Sediment		Pest/PCB	PP Scan	Sediment	
Matrix Spike #2	Result	Units		Matrix Spike #2	Result	Units	
4,4'-DDT	8U	ug/kg		4,4'-DDT	8U	ug/kg	
Chlordane	8U	ug/kg		Chlordane	8U	ug/kg	
Gamma-BHC (Lindane)	8U	ug/kg		Gamma-BHC (Lindane)	8U	ug/kg	
Dieldrin	8U	ug/kg		Dieldrin	8U	ug/kg	
Endrin	8U	ug/kg		Endrin	8U	ug/kg	
Methoxychlor	8U	ug/kg		Methoxychlor	8U	ug/kg	
4,4'-DDD	8U	ug/kg		4,4'-DDD	8U	ug/kg	
4,4'-DDE	8U	ug/kg		4,4'-DDE	8U	ug/kg	
Heptachlor	8U	ug/kg		Heptachlor	8U	ug/kg	
Hexachlorobutadiene	NAR	ug/kg		Hexachlorobutadiene	NAR	ug/kg	
Hexachlorobenzene	NAR	ug/kg		Hexachlorobenzene	NAR	ug/kg	
Aldrin	8U	ug/kg		Aldrin	8U	ug/kg	
alpha-BHC	8U	ug/kg		alpha-BHC	8U	ug/kg	
beta-BHC	8U	ug/kg		beta-BHC	8U	ug/kg	
delta-BHC	8U	ug/kg		delta-BHC	8U	ug/kg	
alpha-Endosulfan	8U	ug/kg		alpha-Endosulfan	8U	ug/kg	
Heptachlor epoxide	8U	ug/kg		Heptachlor epoxide	8U	ug/kg	
Endosulfan sulfate	8U	ug/kg		Endosulfan sulfate	8U	ug/kg	
Endrin aldehyde	8U	ug/kg		Endrin aldehyde	8U	ug/kg	
Toxaphene	210U	ug/kg		Toxaphene	210U	ug/kg	
PCB - 1260	80U	ug/kg		PCB - 1260	80U	ug/kg	
PCB - 1254	80U	ug/kg		PCB - 1254	80U	ug/kg	

Project: DOE-541F GRAYS HARBOR SALMON SURVEY

Laboratory: Ecology, Manchester

Officer: DXR

Source: Sediment (General)

Sample No: 88 228131

Description: ELLIOT SL.

Begin Date: 88/05/23 :

Cyanide	Sedmt	0.05U mg/kg-dr	VOA - PP Scan (GCMS)			VOA - PP Scan (GCMS)			Sediment		
			Sediment Result	Units	Result	Units	Result	Units	Result	Units	Result
Metals - PP	Sediment		1,1-Dichloroethane	10U	ug/kg	2,2-Dichloropropane	10U	ug/kg	2,2-Hexanone	20U	ug/kg
	Result		1,1-Dichloroethane	10U	ug/kg	2,2-Hexanone	10U	ug/kg	Ethane, 1,1,1,2-Tetrachloroethane	10U	ug/kg
	Units		Trichlorofluoromethane	20U	ug/kg	cis-1,3-Dichloropropene	10U	ug/kg	cis-1,3-Dichloropropene	10U	ug/kg
			Methane, Dichlorodifluoromethane	ug/kg		trans-1,3-Dichloropropene	10U	ug/kg	Surrog: D4-1,2-Dichloroethane	10U	ug/kg
			Dichloropropane	ug/kg		Surrog: D4-1,2-Dichloroethane	5U	ug/kg	94% Recov	94%	% Recov
Arsenic	As-Sedmt	4.4 *	1,2-Dichloropropane	10U	ug/kg	Surrog: 1,4-Bromofluorobutane	10U	ug/kg	Surrog: 1,4-Bromofluorobutane	81%	% Recov
Lead	Pb-Sedmt	3.4 *	2-Butanone	10U	ug/kg	Surrog: D8-Toluene	10U	ug/kg	Surrog: D8-Toluene	102%	% Recov
Silver	Ag-Sedmt	0.11 *	1,1,2-Trichloroethane	10U	ug/kg	+ B/N Acid Scan	10U	ug/kg	+ B/N Acid Scan	10U	ug/kg
Antimony	Sb-Sedmt	0.1U mg/kg-dr	Trichloroethene	10U	ug/kg	Benzo(a)Pyrene	130U	ug/kg	Benzo(a)Pyrene	130U	ug/kg
Selenium	Se-Sedmt	1.9 *	1,1,2-Tetrachloroethane	10U	ug/kg	2,4-Dinitrophenol	610U	ug/kg	2,4-Dinitrophenol	610U	ug/kg
Thallium	Tl-Sedmt	0.1U mg/kg-dr	1,2,3-Trichlorobutadiene	10U	ug/kg	Dibenzo(a,h)anthracene	130U	ug/kg	Dibenzo(a,h)anthracene	130U	ug/kg
Mercury	Hg-Sedmt	0.032 *	Naphthalene	10U	ug/kg	Benzol(a)anthracene	130U	ug/kg	Benzol(a)anthracene	130U	ug/kg
			Total Xylenes	10U	ug/kg	4-Chloro-3-Methylphenol	130U	ug/kg	4-Chloro-3-Methylphenol	130U	ug/kg
			2-Chlorotoluene	10U	ug/kg	Hexachlorocyclopentadiene	130U	ug/kg	Hexachlorocyclopentadiene	130U	ug/kg
			1,2,4-Trimethylbenzene	10U	ug/kg	Isophorone	130U	ug/kg	Isophorone	130U	ug/kg
			DBCP	10U	ug/kg	Acenaphthene	130U	ug/kg	Acenaphthene	130U	ug/kg
Beryllium	Be-Sedmt	0.9 *	1,2,3-Trichloropropane	10U	ug/kg	Diethylphthalate	130U	ug/kg	Diethylphthalate	130U	ug/kg
Cadmium	Cd-Sedmt	0.5U mg/kg-dr	Tert-Butylbenzene	10U	ug/kg	Di-n-Butylphthalate	28BJ*	ug/kg	Di-n-Butylphthalate	28BJ*	ug/kg
Chromium	Cr-Sedmt	0.5U mg/kg-dr	Isopropylbenzene (Cumene)	10U	ug/kg	Phenanthrene	110J*	ug/kg	Phenanthrene	110J*	ug/kg
Copper	Cu-Sedmt	30. *	p-Isopropyltoluene	10U	ug/kg	Butylbenzylphthalate	130U	ug/kg	Butylbenzylphthalate	130U	ug/kg
Lead	Pb-Sedmt	46. *	Ethylbenzene	10U	ug/kg	N-Nitrosodiphenylamine	130U	ug/kg	N-Nitrosodiphenylamine	130U	ug/kg
Nickel	Ni-Sedmt	4.1 *	Styrene	10U	ug/kg	Fluorene	130U	ug/kg	Fluorene	130U	ug/kg
Zinc	Zn-Sedmt	52. *	Benzene, Propyl-	10U	ug/kg	Carbazole	130U	ug/kg	Carbazole	130U	ug/kg
Tin	Sn-Sedmt	76. *	Butylbenzene	10U	ug/kg	Hexachlorobutadiene	130U	ug/kg	Hexachlorobutadiene	130U	ug/kg
		96. *	4-Chlorotoluene	10U	ug/kg	Pentachlorophenol	610U	ug/kg	Pentachlorophenol	610U	ug/kg
			1,4-Dichlorobenzene	10U	ug/kg	2,4,6-Trichlorophenol	130U	ug/kg	2,4,6-Trichlorophenol	130U	ug/kg
			1,2-Dibromoethane (EDB)	20U	ug/kg	2-Nitroaniline	610U	ug/kg	2-Nitroaniline	610U	ug/kg
			1,2-Dichloroethane	10U	ug/kg	2-Nitrophenol	130U	ug/kg	2-Nitrophenol	130U	ug/kg
			Vinyl Acetate	20U	ug/kg	Naphthalene, 1-Methyl-	130U	ug/kg	Naphthalene, 1-Methyl-	130U	ug/kg
						Naphthalene	ug/kg		Naphthalene	ug/kg	
Carbon-Tetrachloride			4-Methyl-2-Pentanone	10U	ug/kg	Pentachlorophenol	53BJ*	ug/kg	Pentachlorophenol	610U	ug/kg
Acetone			1,3,5-Trimethylbenzene	10U	ug/kg	2,4,6-Trichlorophenol	130U	ug/kg	2,4,6-Trichlorophenol	130U	ug/kg
Chloroform			Bromobenzene	10U	ug/kg	2-Chloronaphthalene	130U	ug/kg	2-Chloronaphthalene	130U	ug/kg
Benzene			Toluene	10U	ug/kg	3,3'-Dichlorobenzidine	130U	ug/kg	3,3'-Dichlorobenzidine	130U	ug/kg
			Chlorobenzene	10U	ug/kg	2,4-Dichlorobenzene	130U	ug/kg	2,4-Dichlorobenzene	130U	ug/kg
			1,2,4-Trichlorobenzene	20U	ug/kg	Dibromo-chloromethane	130U	ug/kg	Dibromo-chloromethane	130U	ug/kg
			Chloromethane	20U	ug/kg	Tetrachloroethene	130U	ug/kg	Tetrachloroethene	130U	ug/kg
			Dibromomethane	10U	ug/kg	Sec-Butylbenzene	130U	ug/kg	Sec-Butylbenzene	130U	ug/kg
			Chloroethane	20U	ug/kg	1,3-Dichloropropane	10U	ug/kg	1,3-Dichloropropane	10U	ug/kg
			Vinyl Chloride	7U	ug/kg	Cis-1,2-Dichloroethene	10U	ug/kg	Cis-1,2-Dichloroethene	10U	ug/kg
			Methylene Chloride	10U	ug/kg	trans-1,2-Dichloroethene	10U	ug/kg	trans-1,2-Dichloroethene	10U	ug/kg
			Carbon Disulfide	10U	ug/kg	1,3-Dichlorobenzene	10U	ug/kg	1,3-Dichlorobenzene	10U	ug/kg
			Bromoform	10U	ug/kg	o-Chlorophenol	130U	ug/kg	o-Chlorophenol	130U	ug/kg
			Bromodichloromethane	10U	ug/kg	2,4,5-Trichlorophenol	610U	ug/kg	2,4,5-Trichlorophenol	610U	ug/kg

Project: DOE-541F GRAYS HARBOR SALMON SURVEY

Laboratory: Ecology, Manchester

Sample No: 88 228131

Description: ELLIOT SL.

Begin Date: 88/05/23 :

B/N/Acid Scan ***		Continued ***		Sediment		B/N/Acid Scan ***		Continued ***		Sediment		B/N/Acid Scan ***		Continued ***		Sediment	
		Result	Units	Result	Units	Matrix Spike #1	Result	Units	Matrix Spike #1	Result	Units	Matrix Spike #1	Result	Units	Matrix Spike #1	Result	Units
Nitrobenzene		130U	ug/kg	Benzo(a)Pyrene		6.8	% Recov		Din-octyl Phthalate		99B	% Recov					
3-Nitroaniline		610U	ug/kg	2,4-Dinitrophenol		65	% Recov		Hexachlorobenzene		88	% Recov					
4-Nitroaniline		610U	ug/kg	Benzo(a)anthracene		84	% Recov		Anthracene		70	% Recov					
4-Nitrophenol		610U	ug/kg	Benzo(a)anthracene		100	% Recov		1,2,4-Trichlorobenzene		25	% Recov					
Benzyl Alcohol		130U	ug/kg	4-Chloro-3-Methylphenol		78	% Recov		2,4-Dichlorophenol		81	% Recov					
4-Bromophenyl-phenylet+		130U	ug/kg	Benzoic acid		0.8U	% Recov		2,4-Dinitrotoluene		66	% Recov					
2,4-Dimethylphenol		130U	ug/kg	Hexachloroethane		6	% Recov		Pyrene		100	% Recov					
4-MethylPhenol		100J*	ug/kg	Isophorone		0.3U	% Recov		Dimethylphthalate		67	% Recov					
1,4-Dichlorobenzene		130U	ug/kg	Acenaphthene		55	% Recov		Dibenzofuran		61	% Recov					
4-Chloroaniline		130U	ug/kg	Diethylphthalate		62	% Recov		Benz(o)phenylene		120	% Recov					
Phenol		130BU	ug/kg	Di-n-Butylphthalate		67B	% Recov		Indeno(1,2,3-cd)pyrene		82	% Recov					
bis(2-Chloroethyl)Ether		130U	ug/kg	Phenanthrene		97B	% Recov		Benz(o)b)fluoranthene		80	% Recov					
bis(2-Chloroethoxy)Met+		130U	ug/kg	Butylbenzylphthalate		87	% Recov		Fluoranthene		94	% Recov					
BIS(2-ETHYLHEXYL) PHTH+		410B*	ug/kg	N-Nitrosodiphenylamine		100B	% Recov		Benz(o)k)fluoranthene		70	% Recov					
Di-n-Octyl Phthalate		77BJ*	ug/kg	Fluorene		63	% Recov		Acenaphthylene		59	% Recov					
Hexachlorobenzene		130U	ug/kg	Carbazole		6.8	% Recov		Chrysene		80	% Recov					
Anthracene		130U	ug/kg	Hexachlorobutadiene		19	% Recov		Retene		27	% Recov					
1,2,4-Trichlorobenzene		130U	ug/kg	Pentachlorophenol		9	% Recov		4,6-Dinitro-2-methylph+		100	% Recov					
2,4-Dichlorophenol		130U	ug/kg	2,4,6-Trichlorophenol		73	% Recov		4,6-Dichlorobenzene		13	% Recov					
2,4-Dinitrotoluene		130U	ug/kg	2-Nitroaniline		0.8U	% Recov		2,6-Dinitrotoluene		65	% Recov					
Pyrene		1900*	ug/kg	2-Nitrophenol		50	% Recov		N-Nitroso-di-n-Propylat+		55	% Recov					
Dimethylphthalate		130U	ug/kg	Naphthalene, 1-Methyl-		3	% Recov		4-Chlorophenyl-1-phenylet+		63	% Recov					
Dimethylfuran		130U	ug/kg	Naphthalene		37B	% Recov		bis(2-Chloroisopropyl)+		39	% Recov					
Benzo(ghi)Perylene		130U	ug/kg	2-Methylnaphthalene		35	% Recov		1,3-Dichlorobenzene		98	% Recov					
Indeno(1,2,3-cd)Pyrene		130U	ug/kg	2-Chloronaphthalene		54	% Recov		2,6-Dinitrophenol		53	% Recov					
Benzo(b)fluoranthene		1100J*	ug/kg	3,3'-Dichlorobenzidine		0.2U	% Recov		Surrog: 2-Fluorophenol		52	% Recov					
Fluoranthene		170*	ug/kg	2-MethylPhenol		120	% Recov		Surrog: D14-Terphenyl		101	% Recov					
Benzo(k)fluoranthene		96J*	ug/kg	2,2-Dichlorobenzene		18	% Recov		Surrog: D5-Nitrobenzene		44	% Recov					
Acenaphthylene		21J*	ug/kg	o-Chlorophenol		62	% Recov		Surrog: D5-Phenol		67	% Recov					
Chrysene		130U	ug/kg	2,4,5-Trichlorophenol		82	% Recov										
Retene		510*	ug/kg	Nitrobenzene		3.6	% Recov										
4,6-Dinitro-2-methylph+		610U	ug/kg	3-Nitroaniline		100	% Recov										
1,3-Dichlorobenzene		130U	ug/kg	4-Nitroaniline		0.8U	% Recov										
2,6-Dinitrotoluene		130U	ug/kg	4-Nitrophenol		0.8U	% Recov										
N-Nitroso-di-n-Propylat+		130U	ug/kg	Benzyl Alcohol		0.2U	% Recov										
4-Chlorophenyl-1-phenylet+		130U	ug/kg	4-Bromophenyl-1-phenylet+		89	% Recov										
Surrog: D10-Pyrene		130U	ug/kg	2,4-Dimethylphenol		100	% Recov										
Surrog: 2-Fluorobiphen+		105%	% Recov	4-MethylPhenol		96	% Recov										
Surrog: 2-Fluorobiphen+		46%	% Recov	1,4-Dichlorobenzene		14	% Recov										
Surrog: 2-Fluorophenol		35%	% Recov	4-Chloroaniline		0.2U	% Recov										
Surrog: D14-Terphenyl		120%	% Recov	Phenol		65B	% Recov										
Surrog: D5-Nitrobenzene		27%	% Recov	bis(2-Chloroethyl)Ether		41	% Recov										
Surrog: D5-Phenol		42%	% Recov	bis(2-Chloroethoxy)Met+		52	% Recov										
				BIS(2-ETHYLHEXYL) PHTH+		110B	% Recov										

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Project: DOE-541F GRAYS HARBOR SALMON SURVEY

Officer: DXR Account: 41652

Laboratory: Ecology, Manchester

Sample No: 88 228131 Description: ELLIOT SL.

Begin Date: 88/05/23 :

Source: Sediment (General)

B/N/Acid Scan	Sediment	B/N/Acid Scan	Sediment	Resin Acids Guaiacol	Sediment
Matrix Spike #2	Result	Units	Matrix Spike #2	Result	Units
Diethylphthalate	77B	% Recov	Benzo(ghi)Perylene	86	% Recov
Di-n-Butylphthalate	100B	% Recov	Indeno[1,2,3-cd]pyrene	82	% Recov
Phenanthrene	8.6	% Recov	Benzo(b)fluoranthene	9.0	% Recov
Butylbenzylphthalate	120B	% Recov	Fluoranthene	9.7	% Recov
N-Nitrosodiphenylamine	70	% Recov	Benzo(k)fluoranthene	6.8	% Recov
Fluorene	8.2	% Recov	Acenaphthylenone	7.5	% Recov
Carbazole	0.2U	% Recov	Chrysene	7.5	% Recov
Hexachlorobutadiene	1.8	% Recov	Retene	2.3	% Recov
Pentachlorophenol	0.8U	% Recov	4,6-Dinitro-2-methylphenol	9.1	% Recov
2,4,6-Trichlorophenol	70	% Recov	1,3-Dichlorobenzene	1.2	% Recov
2-Nitroaniline	0.8U	% Recov	2,6-Dinitrotoluene	7.6	% Recov
2-Nitrophenol	4.6	% Recov	N-Nitroso-di-n-Propyl +	5.6	% Recov
Naphthalene, 1-Methyl-	3	% Recov	4-Chlorophenyl-phenyle +	7.5	% Recov
Naphthalene	39B	% Recov	bis(2-Chloroisopropyl) +	3.7	% Recov
2-Methylnaphthalene	3.8	% Recov	Surrog: D10-Pyrene	10.2	% Recov
2-Chloronaphthalene	6.2	% Recov	Surrog: 2-Fluorobiphenol	5.9	% Recov
3,3'-Dichlorobenzidine	0.2U	% Recov	Surrog: 2-Fluorophenol	5.1	% Recov
2-Methylphenol	7.4	% Recov	Surrog: D14-Terphenyl	11.0	% Recov
1,2-Dichlorobenzene	1.8	% Recov	Surrog: D5-Nitrobenzene	4.7	% Recov
o-Chlorophenol	5.8	% Recov	Surrog: D5-Phenol	6.1	% Recov
2,4,5-Trichlorophenol	8.0	% Recov			
Nitrobenzene	3.5	% Recov			
3-Nitroaniline	6.6	% Recov			
4-Nitroaniline	0.8U	% Recov			
4-Nitrophenol	0.8U	% Recov			
Benzyl Alcohol	0.2U	% Recov	Linoleic acid	1600 *	ug/kg
4-Bromophenyl-phenyle +	8.5	% Recov	Guaiacol (2-methoxyphenol)	120U	ug/kg
2,4-Dimethylphenol	100	% Recov	4-Allylguaiacol (eugenol)	120U	ug/kg
4-Methylphenol	7.9	% Recov	Oleic acid	2300J*	ug/kg
1,4-Dichlorobenzene	14	% Recov	Sandaracopimaric acid	120U	ug/kg
4-Chloroaniline	150	% Recov	Abietic acid	120U	ug/kg
Phenol	58B	% Recov	Tetrachloroguaiacol	120U	ug/kg
4-(2-Chloroethyl) Ether	4.2	% Recov	4,5,6-Trichloroguaiacol	120U	ug/kg
bis(2-Chloroethoxy) Met+	53	% Recov	9,10-Dichlorosteric acid	120U	ug/kg
BIS(2-ETHYLHEXYL) PHTH+	120B	% Recov	Dichlorodehydroabietic +	80J*	ug/kg
Di-n-Octyl Phthalate	100B	% Recov	Dehydroabietic acid	9.80 *	ug/kg
Hexachlorobenzene	8.6	% Recov	4,5-Dichloroguaiacol	120U	ug/kg
Anthracene	7.6	% Recov	Trichlorosyringol	120U	ug/kg
1,2,4-Trichlorobenzene	2.9	% Recov	Isopimaric acid	210J*	ug/kg
2,4-Dichlorophenol	8.1	% Recov	4-Chloroguaiacol	120U	ug/kg
2,4-Dinitrotoluene	75	% Recov	Surrog: Pyrene D10	5.9%	% Recov
Pyrene	11.0	% Recov	Surrog: 2-Fluoro-1-methyl	4.2%	% Recov
Dimethylphthalate	7.9	% Recov	Surrog: 2-Fluorobiphenol	3.8%	% Recov
Dibenzofuran	74	% Recov	Surrog: 2-Fluorophenol	3.3%	% Recov

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Washington State Department of Ecology
Sample/Project Analysis Results

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Project: DOE-541F GRAYS HARBOR SALMON SURVEY

Laboratory: Ecology, Manchester

Officer: DXR Account: 41652

Sample No: 88 228131 Description: ELLIOT SL.

Begin Date: 88/05/23 :

Pest/PCB	PP Scan	Sediment	
	***	Continued ***	
		Result	Units
PCB - 1221		10U	ug/kg
PCB - 1232		10U	ug/kg
PCB - 1248		10U	ug/kg
PCB - 1016		10U	ug/kg
beta-Endosulfan		1U	ug/kg
PCB - 1242		10U	ug/kg
Int Std: Hexabromobenzene+	107%	% Recov	

Source: Sediment (General)

Project: DOE-541F GRAYS HARBOR SALMON SURVEY

Officer: DXR Account: 41652

Laboratory: Ecology, Manchester

Sample No: 88 228132 Description: COW POINT

Begin Date: 88/05/23 :

Source: Sediment (General)

Cyanide	Sedmt	Sediment			VOA - PP Scan (GCMS)			Sediment			VOA - PP Scan (GCMS)			Sediment		
		Result	Units	Result	Units	***	Continued	Result	Units	Result	Units	***	Continued	Result	Units	
0.04U	mg/kg-dr	1,1-Dichloroethane	8U	ug/kg	2,2-Dichloropropane	8U	ug/kg	2-Hexanone	16U	ug/kg	2-Hexanone	8U	ug/kg	Ethane, 1,1,1,2-Tetrach+	8U	ug/kg
		1,1-Dichloroethene	8U	ug/kg	cis-1,3-Dichloropropene	8U	ug/kg	cis-1,3-Dichloropropene	8U	ug/kg	trans-1,3-Dichloroprop+	8U	ug/kg	trans-1,3-Dichloroprop+	8U	ug/kg
		Methane, Dichlorodiflu+	16U	ug/kg	Surroq: D4-1,2-Dichloro+	91%	% Recov	Surroq: D4-1,2-Dichloro+	91%	% Recov	Surroq: D4-1,2-Dichloro+	82%	% Recov	Surroq: D4-1,2-Dichloro+	82%	% Recov
		1,2-Dichloropropane	8U	ug/kg	Surroq: D8-Toluene	98%	% Recov	Surroq: D8-Toluene	98%	% Recov	Surroq: D8-Toluene	98%	% Recov	Surroq: D8-Toluene	98%	% Recov
		2-Butanone	0.7U	ug/kg	B/N/Acid Scan	100U	ug/kg	Benz(a)Pyrene	480U	ug/kg	2,4-Dinitrophenol	100U	ug/kg	Dibenzo(a,h)anthracene	16J*	ug/kg
		2-Butanone	0.7U	ug/kg	Benz(a)anthracene	100U	ug/kg	Benz(a)anthracene	100U	ug/kg	4-Chloro-3-Methylphenol	100U	ug/kg	Benzoic acid	480U	ug/kg
		1,1,2-Trichloroethane	8U	ug/kg	Hexachloroethane	100U	ug/kg	Hexachloroethane	100U	ug/kg	Hexachlorocyclopentadi+	200U	ug/kg	Isophorone	100U	ug/kg
		Trichloroethene	8U	ug/kg	Isophorone	100U	ug/kg	Isophorone	100U	ug/kg	Acenaphthene	100U	ug/kg	Acenaphthene	100U	ug/kg
		1,1,2,2-Tetrachloroeth+	8U	ug/kg	Diethylphthalate	100BU	ug/kg	Diethylphthalate	100BU	ug/kg	Di-n-Butylphthalate	29BJ*	ug/kg	Di-n-Butylphthalate	29BJ*	ug/kg
		1,2,3-Trichlorobenzene	8U	ug/kg	Phenanthrene	51J*	ug/kg	Phenanthrene	51J*	ug/kg	Phenanthrene	100BU	ug/kg	N-Nitrosodiphenylamine	100U	ug/kg
		Hexachlorobutadiene	8U	ug/kg	Butylbenzylphthalate	100U	ug/kg	Butylbenzylphthalate	100U	ug/kg	Fluorene	10J*	ug/kg	Carbazole	100U	ug/kg
		1,2,4-Trimethylbenzene	8U	ug/kg	Fluorene	10J*	ug/kg	Fluorene	10J*	ug/kg	Hexachlorobutadiene	100U	ug/kg	Pentachlorophenol	480U	ug/kg
		DBCP	8U	ug/kg	Pentachlorophenol	100U	ug/kg	Pentachlorophenol	100U	ug/kg	2,4,6-Trichlorophenol	100U	ug/kg	2-Nitroaniline	480U	ug/kg
		1,2,3-Trichloropropane	8U	ug/kg	2-Nitroaniline	100U	ug/kg	2-Nitroaniline	100U	ug/kg	2-Nitrophenol	100U	ug/kg	2-Nitrophenol	100U	ug/kg
		Tert-Butylbenzene	8U	ug/kg	2-Nitrophenol	100U	ug/kg	2-Nitrophenol	100U	ug/kg	Naphthalene, 1-Methyl-	100U	ug/kg	Naphthalene	34BJ*	ug/kg
		Isopropylbenzene (Cum+	8U	ug/kg	Naphthalene	100U	ug/kg	Naphthalene	100U	ug/kg	2-Methylnaphthalene	9J*	ug/kg	2-Methylnaphthalene	100U	ug/kg
		p-Isopropyltoluene	8U	ug/kg	2-Methylnaphthalene	100U	ug/kg	2-Methylnaphthalene	100U	ug/kg	3-Chloronaphthalene	100U	ug/kg	3-Chloronaphthalene	100U	ug/kg
		Ethylbenzene	8U	ug/kg	3-Chloronaphthalene	100U	ug/kg	3-Chloronaphthalene	100U	ug/kg	3,3'-Dichlorobenzidine	100U	ug/kg	3,3'-Dichlorobenzidine	100U	ug/kg
		Styrene	8U	ug/kg	3,3'-Dichlorobenzidine	100U	ug/kg	3,3'-Dichlorobenzidine	100U	ug/kg	2-MethylPhenol	100U	ug/kg	2-MethylPhenol	100U	ug/kg
		Benzene, Propyl-	8U	ug/kg	2-MethylPhenol	100U	ug/kg	2-MethylPhenol	100U	ug/kg	1,2-Dichlorobenzene	100U	ug/kg	1,2-Dichlorobenzene	100U	ug/kg
		Butylbenzene	8U	ug/kg	1,2-Dichlorobenzene	100U	ug/kg	1,2-Dichlorobenzene	100U	ug/kg	Dibromochloromethane	8U	ug/kg	Dibromochloromethane	8U	ug/kg
		4-Chlorotoluene	8U	ug/kg	Dibromochloromethane	8U	ug/kg	Dibromochloromethane	8U	ug/kg	1,3,5-Trimethylbenzene	8U	ug/kg	1,3,5-Trimethylbenzene	8U	ug/kg
		4-Chlorotoluene	8U	ug/kg	1,3,5-Trimethylbenzene	8U	ug/kg	1,3,5-Trimethylbenzene	8U	ug/kg	Bromobenzene	8U	ug/kg	Bromobenzene	8U	ug/kg
		1,4-Dichlorobenzene	8U	ug/kg	Bromobenzene	8U	ug/kg	Bromobenzene	8U	ug/kg	Tetrachloroethene	8U	ug/kg	Tetrachloroethene	8U	ug/kg
		(EDB)	16U	ug/kg	Tetrachloroethene	8U	ug/kg	Tetrachloroethene	8U	ug/kg	Sec-Butylbenzene	8U	ug/kg	Sec-Butylbenzene	8U	ug/kg
		1,2-Dichloroethane	16U	ug/kg	Sec-Butylbenzene	8U	ug/kg	Sec-Butylbenzene	8U	ug/kg	1,3-Dichlorobenzene	8U	ug/kg	1,3-Dichlorobenzene	8U	ug/kg
		1,2-Dichloroethane	16U	ug/kg	1,3-Dichlorobenzene	8U	ug/kg	1,3-Dichlorobenzene	8U	ug/kg	1,2,4-Trichlorobenzene	8U	ug/kg	1,2,4-Trichlorobenzene	8U	ug/kg
		Vinyl Acetate	16U	ug/kg	1,2,4-Trichlorobenzene	8U	ug/kg	1,2,4-Trichlorobenzene	8U	ug/kg	Chlorobenzene	8U	ug/kg	Chlorobenzene	8U	ug/kg
		4-Methyl-2-Pentanone	16U	ug/kg	Chlorobenzene	8U	ug/kg	Chlorobenzene	8U	ug/kg	1,2,4-Trichlorobenzene	8U	ug/kg	1,2,4-Trichlorobenzene	8U	ug/kg
		1,3,5-Trimethylbenzene	16U	ug/kg	1,2,4-Trichlorobenzene	8U	ug/kg	1,2,4-Trichlorobenzene	8U	ug/kg	Dibromochloromethane	8U	ug/kg	Dibromochloromethane	8U	ug/kg
		Bromobenzene	16U	ug/kg	Dibromochloromethane	8U	ug/kg	Dibromochloromethane	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg
		Toluene	16U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg
		Chlorobenzene	16U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg
		Chlorobenzene	16U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg
		Chlorobenzene	16U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg
		Chlorobenzene	16U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg
		Chlorobenzene	16U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg
		Chlorobenzene	16U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg
		Chlorobenzene	16U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg
		Chlorobenzene	16U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg
		Chlorobenzene	16U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg
		Chlorobenzene	16U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg
		Chlorobenzene	16U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg
		Chlorobenzene	16U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg
		Chlorobenzene	16U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg
		Chlorobenzene	16U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg
		Chlorobenzene	16U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg
		Chlorobenzene	16U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg
		Chlorobenzene	16U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg
		Chlorobenzene	16U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg
		Chlorobenzene	16U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg
		Chlorobenzene	16U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg
		Chlorobenzene	16U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg
		Chlorobenzene	16U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg
		Chlorobenzene	16U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg
		Chlorobenzene	16U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg
		Chlorobenzene	16U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg
		Chlorobenzene	16U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg
		Chlorobenzene	16U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg
		Chlorobenzene	16U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg
		Chlorobenzene	16U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg
		Chlorobenzene	16U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg
		Chlorobenzene	16U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg
		Chlorobenzene	16U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg
		Chlorobenzene	16U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg
		Chlorobenzene	16U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg
		Chlorobenzene	16U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg
		Chlorobenzene	16U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg
		Chlorobenzene	16U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	8U	ug/kg
		Chlorobenzene	16U													

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Washington State Department of Ecology
Sample/Project Analysis Results

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Project: DOE-541F GRAYS HARBOR SALMON SURVEY

Laboratory: Ecology, Manchester

Sample No: 88 228132 Description: COW POINT

Begin Date: 88/05/23 :

Misc GC Specified	Sediment Result	Units	ug/kg
Aldicarb	230U		
Simazine	120U		
Diuron	120U		
Atrazine	45U		
Butylate	45U		
Metrribuzin	45U		
Fenamiphos	23U		
Pronamide	120U		
Hexazinone	23U		

Pest/PCB - PP Scan	Sediment Result	Units	ug/kg
4,4' -DDT	1U		
Chlordane	1U		
gamma-BHC (Lindane)	1U		
Enddrin	1U		
4,4' -DDD	1U		
4,4' -DDD	1U		
Heptachlor	1U		
Aldrin	1U		
alpha-BHC	1U		
beta-BHC	1U		
delta-BHC	1U		
alpha-Endosulfan	1U		
Heptachlor epoxide	1U		
Endosulfan sulfate	1U		
Endrin aldehyde	1U		
Toxaphene	30U		
PCB - 1260	10U		
PCB - 1254	10U		
PCB - 1221	10U		
PCB - 1232	10U		
PCB - 1248	10U		
PCB - 1016	10U		
beta-Endosulfan	1U		
PCB - 1242	10U		
Intstd: Hexabromobenzene	84%	% Recov	

Officer: DXR Account: 41652

Source: Sediment (General)

Project: DOE-541F GRAYS HARBOR SALMON SURVEY

Laboratory: Ecology, Manchester

Sample No: 88 228133

Description: AT WEYCO

Begin Date: 88/05/23 :

Gen Inorg/Phys-Speci		Sediment	VOA - PP Scan (GCMS)		Sediment	VOA - PP Scan (GCMS)		Sediment	
		Result	Units	Result	Units	Result	Units	Result	
Cyanide	Sedmt	0.03U	mg/kg-dr	1,1-Dichloroethane	6U	ug/kg	2,2-Dichloropropane	6U	ug/kg
				1,1-Dichloroethene	6U	ug/kg	2-Hexanone	12U	ug/kg
				Trichlorofluoromethane	6U	ug/kg	Ethane, 1,1,1,2-Tetrachloro	6U	ug/kg
				Methane, Dichlorodifluoromethane	12U	ug/kg	cis-1,3-Dichloropropene	6U	ug/kg
				Dichloropropane	6U	ug/kg	trans-1,3-Dichloropropene	6U	ug/kg
				1,2-Dichloroethane	6U	ug/kg	Surrog: D4-1,2-Dichloroethane	97%	% Recov
				2-Butanone	2U	ug/kg	Surrog: 1,4-Bromofluorobutane	85%	% Recov
				2-Butane	6U	ug/kg	Surrog: D8-Toluene	100%	% Recov
				Trichloroethene	6U	ug/kg	B/N/Acid Scan		
				1,1,2,2-Tetrachloroethane	6U	ug/kg			
				1,1,2,3-Tetrachlorobenzene	6U	ug/kg			
				Hexachlorobutadiene	6U	ug/kg			
				Naphthalene	6U	ug/kg			
				Total Xylenes	6U	ug/kg			
				2-Chlorotoluene	6U	ug/kg	Benz(a)pyrene	76U	ug/kg
				1,2-Dichlorobenzene	6U	ug/kg	2,4-Dinitrophenol	370U	ug/kg
				1,2,4-Trimethylbenzene	6U	ug/kg	Dibenz(a,h)anthracene	76U	ug/kg
				DBCP	6U	ug/kg	Benz(a)anthracene	19J*	ug/kg
				1,2,3-Trichloropropane	6U	ug/kg	4-Chloro-3-Methylphenol	76U	ug/kg
				1,2,4-Trichlorobenzene	6U	ug/kg	Benzoic acid	370U	ug/kg
				Tert-Butylbenzene	6U	ug/kg	Hexachloroethane	76U	ug/kg
				Isopropylbenzene (Cumene)	6U	ug/kg	Hexachlorocyclopentadiene	150U	ug/kg
				p-Isopropyltoluene	6U	ug/kg	Isophorone	76U	ug/kg
				Ethylbenzene	6U	ug/kg	Acenaphthene	31J*	ug/kg
				Styrene	6U	ug/kg	Diethylphthalate	76BU	ug/kg
				Benzene, Propyl-	6U	ug/kg	Di-n-Butylphthalate	25BJ*	ug/kg
				Benzylbenzene	6U	ug/kg	Phenanthrene	110*	ug/kg
				4-Chlorotoluene	6U	ug/kg	Butylbenzylphthalate	76BU	ug/kg
				4-Chlorobenzene	6U	ug/kg	N-Nitrosodiphenylamine	76U	ug/kg
				1,4-Dichlorobenzene	12U	ug/kg	Fluorene	23J*	ug/kg
				1,2-Dibromoethane (EDB)	6U	ug/kg	Carbazole	76U	ug/kg
				1,2-Dichloroethane	12U	ug/kg	Hexachlorobutadiene	76U	ug/kg
				Vinyl Acetate	12U	ug/kg	Pentachlorophenol	370U	ug/kg
				4-Methyl-2-Pentanone	12U	ug/kg	2,4,6-Trichlorophenol	76U	ug/kg
				1,3,5-Trimethylbenzene	6U	ug/kg	2-Nitroaniline	370U	ug/kg
				Bromobenzene	6U	ug/kg	2-Nitrophenol	76U	ug/kg
				Toluene	6U	ug/kg	Naphthalene, 1-Methyl-	20J*	ug/kg
				Chlorobenzene	6U	ug/kg	Naphthalene	45BJ*	ug/kg
				1,2,4-Trichlorobenzene	6U	ug/kg	2-Methylnaphthalene	11J*	ug/kg
				Dibromochloromethane	6U	ug/kg	2-Chloronaphthalene	76U	ug/kg
				Chloroethane	12U	ug/kg	Sec-Butylbenzene	76U	ug/kg
				Bromomethane	12U	ug/kg	1,3-Dichloropropane	76U	ug/kg
				Dibromomethane	12U	ug/kg	Cis-1,2-Dichloroethene	76U	ug/kg
				Chloroethane	12U	ug/kg	trans-1,2-Dichloroethene	76U	ug/kg
				Bromoethane	12U	ug/kg	1,3-Dichlorobenzene	76U	ug/kg
				Vinyl Chloride	12U	ug/kg	Methylphenol	76U	ug/kg
				Methylene Chloride	4U	ug/kg	1,2-Dichlorobenzene	76U	ug/kg
				Carbon Disulfide	6U	ug/kg	o-Chlorophenol	76U	ug/kg
				Bromoform	6U	ug/kg	2,4,5-Trichlorophenol	370U	ug/kg
				Bromodichloromethane	6U	ug/kg			

Project: DOE-541F GRAYS HARBOR SALMON SURVEY

Officer: DXR Account: 41652

Laboratory: Ecology, Manchester

Sample No: 88 228133 Description: AT WEYCO

Begin Date: 88/05/23 :

B/N/Acid Scan	Continued ***	Sediment			Resin Acids Guaiacol			Sediment Result			Pest/PCB - PP Scan			Sediment Result			Units													
		Result	Units		Linoleic acid	Guaiacol (2-methoxyphen+)	Oleic acid	Sandaracopimaric acid	Abietic acid	Tetrachloroguaiacol	4,5,6-Trichloroguaiacol	9,10-Dichlorosteric ac+	Dichlorodehydroabietic+	Dehydroabietic acid	4,5-Dichloroguaiacol	Trichlorosyringol	Isopimaric acid	4-Chloroguaiacol	Surrog: Pyrene D10	Surrog: 2-Fluoro,1-met+	Surrog: 2-Fluorobiphen+	Surrog: 2-Fluorophenol	Surrog: Heptadecanoic +	Surrog: D14-Terphenyl	Surrog: 2-Naphthoic ac+	Surrog: D5-Nitrobenzene	Surrog: D5-Phenol	Surrog: o-Methylipodocat+	Int Std: Hexabromobenzene	73 % Recov
Nitrobenzene		76U	ug/kg		Guaiacol (2-methoxyphen+)	76U	ug/g			76U	ug/g				4,4'-DDT	Chlordane	Gamma-BHC (Lindane)	Endrin	4,4'-DDD	4,4'-DDE	Heptachlor	Aldrin	alpha-BHC	beta-BHC	delta-BHC	alpha-Endosulfan	Heptachlor epoxide	Endosulfan sulfate	Endrin aldehyde	73 % Recov
3-Nitroaniline		370U	ug/kg		4-Allylguaiacol (eugen+)	76U	ug/g			1400J*	ug/kg																			
4-Nitrophenol		370U	ug/kg		Oleic acid	76U	ug/kg																							
4-Nitropheno1		370U	ug/kg		Sandaracopimaric acid	76U	ug/kg																							
Benzyl Alcohol		76U	ug/kg		Abietic acid	76U	ug/kg																							
4-Bromophenyl-phenylet+		76U	ug/kg		Tetrachloroguaiacol	76U	ug/g																							
2,4-Dimethylphenol		76U	ug/kg		4,5,6-Trichloroguaiacol	76U	ug/g																							
4-Methylphenol	46J*	ug/kg			9,10-Dichlorosteric ac+	76U	ug/g																							
1,4-Dichlorobenzene		76U	ug/kg		Dichlorodehydroabietic+	76U	ug/g																							
4-Chloroaniline		76U	ug/kg		Dehydroabietic acid	76U	ug/kg	*		1408*	ug/kg																			
Phenol		76U	ug/kg		4,5-Dichloroguaiacol	76U	ug/g																							
bis(2-Chloroethoxy)Ether		76U	ug/kg		Trichlorosyringol	76U	ug/g																							
bis(2-Chloroethoxy)Met+		76U	ug/kg		Isopimaric acid	76U	ug/g																							
BIS(2-ETHYLHEXYL) PHTH+	3220B*	ug/kg			4-Chloroguaiacol	76U	ug/kg																							
Di-n-Octyl Phthalate		76BU	ug/kg		Surrog: Pyrene D10	76U	ug/kg			41 ½ % Recov	ug/kg																			
Hexachlorobenzene		76U	ug/kg		Surrog: 2-Fluoro,1-met+	76U	ug/kg			5 2 ¾ % Recov	ug/kg																			
Anthracene		76U	ug/kg		Surrog: 2-Fluorobiphen+	76U	ug/kg			27 ¾ % Recov	ug/kg																			
1,2,4-Trichlorobenzene		76U	ug/kg		Surrog: 2-Fluorophenol	76U	ug/kg			28 ¾ % Recov	ug/kg																			
2,4-Dichlorophenol		76U	ug/kg		Surrog: Heptadecanoic +	76U	ug/kg			104 ¼ % Recov	ug/kg																			
2,4-Dinitrotoluene		76U	ug/kg		Surrog: D14-Terphenyl	76U	ug/kg			40 ¾ % Recov	ug/kg																			
Pyrene	110 *	ug/kg			Surrog: 2-Naphthoic ac+	76U	ug/kg			6 6 ½ % Recov	ug/kg																			
Dimethylphthalate		76U	ug/kg		Surrog: D5-Nitrobenzene	76U	ug/kg			21 ½ % Recov	ug/kg																			
Dibenzofuran		19J *	ug/kg		Surrog: D5-Phenol	76U	ug/kg			39 ¾ % Recov	ug/kg																			
Benzo(g,h,i)perylene		76U	ug/kg		Surrog: o-Methylipodocat+	76U	ug/kg			72 ½ % Recov	ug/kg																			
Indeno(1,2,3-cd)Pyrene		76U	ug/kg		Int Std: Hexabromobenzene	73 % Recov																								
Benzo(b)fluoranthene		76U	ug/kg																											
Fluoranthene	95 *	ug/kg			Misc GC Specified																									
Benzo(k)fluoranthene		76U	ug/kg																											
Acenaphthylene	4J *	ug/kg																												
Chrysene		76U	ug/kg																											
Retene		76U	ug/kg																											
4,6-Dinitro-2-methylph+		370U	ug/kg																											
1,3-Dichlorobenzene		76U	ug/kg																											
2,6-Dinitrotoluene		76U	ug/kg																											
N-Nitroso-di-n-Propyl-		76U	ug/kg																											
4-Chlorophenyl-phenylet+		76U	ug/kg																											
bis(2-Chloroisopropyl)+		76U	ug/kg																											
Surrog: D10-Pyrene		89 %	% Recov																											
Surrog: 2-Fluorobiphen+		58 %	% Recov																											
Surrog: 2-Fluorophenol		42 %	% Recov																											
Surrog: D14-Terphenyl		96 %	% Recov																											
Surrog: D5-Nitrobenzene		37 %	% Recov																											
Surrog: D5-Phenol		44 %	% Recov																											

(Sample Complete)

Project: DOE-541F GRAYS HARBOR SALMON SURVEY

Laboratory: Ecology, Manchester

Sample No: 88 228134

Description: AT WEYCO (R)

Begin Date: 88/05/23 :

Gen Inorg/Phys-Speci		Sediment		VOA - PP Scan (GCMS)		Sediment		VOA - PP Scan (GCMS)		Sediment	
Cyanide	Sedmt	Result	Units	Result	Units	Result	Units	Result	Units	Result	Units
		0.04U	mg/kg-dr	1,1-Dichloroethane	8U	ug/kg	2,2-Dichloropropane	8U	ug/kg		
				1,1-Dichloroethane	8U	ug/kg	2-Hexanone	16U	ug/kg		
				Trichlorofluoromethane	8U	ug/kg	Ethane, 1,1,1-Tetrach+	8U	ug/kg		
				Methane, Dichlorodiflu+	16U	ug/kg	cis-1,3-Dichloropropene	8U	ug/kg		
				1,2-Dichloropropane	8U	ug/kg	trans-1,3-Dichloroprop+	8U	ug/kg		
				2-Butanone	3U	ug/kg	Surrog: D4-1,2-Dichlor+	103%	% Recov		
				1,1,2-Trichloroethane	8U	ug/kg	Surrog: 1,4-Bromofluor+	88%	% Recov		
				Trichloroethene	8U	ug/kg	Surrog: D8-Toxene	101%	% Recov		
				1,1,2,2-Tetrachloroeth+	8U	ug/kg					
				1,2,3-Trichlorobenzene	8U	ug/kg					
				Hexachlorobutadiene	8U	ug/kg					
				Naphthalene	8U	ug/kg					
				Total Xylenes	8U	ug/kg					
				2-Chlorotoluene	8U	ug/kg	Benzo(a)Pyrene	91U	ug/kg		
				1,2-Dichlorobenzene	8U	ug/kg	2,4-Dinitrophenol	440U	ug/kg		
				1,2,4-Trimethylbenzene	8U	ug/kg	Dibenzo(a,h)anthracene	91U	ug/kg		
				DBCP	8U	ug/kg	Benzo(a)anthracene	91U*	ug/kg		
				1,2,3-Trichloropropane	8U	ug/kg	4-Chloro-3-Methylphenol	91U	ug/kg		
				Tert-Butylbenzene	8U	ug/kg	Benzoic acid	440U	ug/kg		
				Isopropylbenzene (Cumene)	8U	ug/kg	Hexachloroethane	91U	ug/kg		
				(P-Isopropyltoluene	8U	ug/kg	Hexachlorocyclopentadi+	180U	ug/kg		
				Ethylbenzene	8U	ug/kg	Isophorone	91U	ug/kg		
				Styrene	8U	ug/kg	Acenaphthene	71J*	ug/kg		
				Benzene, Propyl-	8U	ug/kg	Diethylphthalate	91BU	ug/kg		
				Benzylbenzene	8U	ug/kg	Di-n-Butylphthalate	91BU	ug/kg		
				4-Chlorotoluene	8U	ug/kg	Phenanthrene	530*	ug/kg		
				1,4-Dichlorobenzene	8U	ug/kg	Butylbenzylphthalate	91BU	ug/kg		
				1,2-Dibromoethane (EDB)	16U	ug/kg	N-Nitrosodiphenylamine	91J	ug/kg		
				1,2-Dichloroethane	8U	ug/kg	Carbazole	91U	ug/kg		
				Vinyl Acetate	16U	ug/kg	Hexachlorobutadiene	91U	ug/kg		
				4-Methyl-2-Pentanone	16U	ug/kg	Pentachlorophenol	440U	ug/kg		
				1,3,5-Trimethylbenzene	8U	ug/kg	Fluorene	79J*	ug/kg		
				Bromobenzene	8U	ug/kg					
				Toluene	0.2U	ug/kg					
				Chlorobenzene	8U	ug/kg					
				Chloroethene	8U	ug/kg					
				1,2,4-Trichlorobenzene	8U	ug/kg					
				Dibromochloromethane	8U	ug/kg					
				Tetrachloroethene	8U	ug/kg					
				Sec-Butylbenzene	0.2U	ug/kg					
				1,3-Dichloropropane	8U	ug/kg					
				Cis-1,2-Dichloroethene	8U	ug/kg					
				trans-1,2-Dichloroeth+	8U	ug/kg					
				1,3-Dichlorobenzene	8U	ug/kg					
				1,1-Dichloropropane	8U	ug/kg					

(Continued on next page)

Project: DOE-541F GRAYS HARBOR SALMON SURVEY

Officer: DXR Account: 41652

Laboratory: Ecology, Manchester

Sample No: 88 228134 Description: AT WEYCO (R)

Begin Date: 88/05/23 :

Source: Sediment (General)

B/N/Acid Scan	Continued ***	Sediment			Resin Acids Guaiacol			Sediment			Pest/PCB - PP Scan			Sediment		
		Result	Units		Result	Units		Result	Units		Result	Units		Result	Units	
Nitrobenzene		91U	ug/kg		Linoleic acid			440J*	ug/kg		4, 4'-DDT			1U	ug/kg	
3-Nitroaniline		440U	ug/kg		Guaiacol (2-methoxyphen+ 4-Allylguaiacol (eugen+			91U	ug/kg		Chlordane			1U	ug/kg	
4-Nitroaniline		440U	ug/kg		Oleic acid			740J*	ug/kg		Gamma-BHC (Lindane)			1U	ug/kg	
4-Nitropheno1		440U	ug/kg		Sandaracopimamic acid			91U	ug/kg		Dieldrin			1U	ug/kg	
Benzyl Alcohol		91U	ug/kg		Abietic acid			66J*	ug/kg		Endrin			1U	ug/kg	
4-Bromophenyl-phenylet+		91U	ug/kg		Tetrachloroguaia1col			91U	ug/kg		4, 4'-DDD			1U	ug/kg	
2, 4-Dimethylphenol		91U	ug/kg		4, 5, 6-Trichloroguaia1col			91U	ug/kg		Heptachlor			1U	ug/kg	
BIS(2-ETHYLHEXYL) PHTH+		130 *	ug/kg		9, 10-Dichloroesteric ac+			91U	ug/kg		Aldrin			1U	ug/kg	
1, 4-Dichlorobenzene		91U	ug/kg		Dichlorodenydroabietic+			91U	ug/kg		alpha-BHC			1U	ug/kg	
4-Chloroaniline		91U	ug/kg		Dehydroabietic acid			260JB*	ug/kg		beta-BHC			1U	ug/kg	
Phenol		91U	ug/kg		4, 5-Dichloroguaia1col			91U	ug/kg		delta-BHC			1U	ug/kg	
bis(2-Chloroethyl) Ether		91U	ug/kg		Trichlorostryringol			91U	ug/kg		alpha-Endosulfan			1U	ug/kg	
bis(2-Chloroethoxy)Met+		91U	ug/kg		Isopimaric acid			91U	ug/kg		Heptachlor epoxide			1U	ug/kg	
BIS(2-ETHYLHEXYL) PHTH+		82BJ*	ug/kg		4-Chloroguaia1col			91U	ug/kg		Endosulfan sulfate			1U	ug/kg	
Di-n-Octyl Phthalate		91BU	ug/kg		Surrog: Pyrene D10			91U	ug/kg		Endrin aldehyde			1U	ug/kg	
Hexachlorobenzene		91U	ug/kg		Surrog: 2-Fluoro, 1-met+			42 %	% Recov		Delta-BHC			1U	ug/kg	
Anthracene		53J*	ug/kg		Surrog: 2-Fluorobiphenol+			91U	ug/kg		alpha-Endosulfan			1U	ug/kg	
1, 2, 4-Trichlorobenzene		91U	ug/kg		Surrog: 2-Fluorophenol			91U	ug/kg		Heptachlor epoxide			1U	ug/kg	
2, 4-Dichlorotoluene		91U	ug/kg		Surrog: Heptadecanoic +			91U	ug/kg		Endosulfan sulfate			1U	ug/kg	
2, 4-Dinitrotoluene		91U	ug/kg		Surrog: D14-Terphenyl			91U	ug/kg		Endrin aldehyde			1U	ug/kg	
Pyrene		640 *	ug/kg		Surrog: 2-Naphthoic ac+			30U	% Recov		Toxaphene			30U	ug/kg	
Dimethylphthalate		91U	ug/kg		Surrog: D5-Nitrobenzene			15 %	% Recov		PCB - 1260			10U	ug/kg	
Dibenzofuran		31J*	ug/kg		Surrog: D5-Phenol			30 %	% Recov		PCB - 1254			10U	ug/kg	
Benzo(ghi)perylene		91U	ug/kg		Surrog: o-Methylpodoc+			106 %	% Recov		PCB - 1221			10U	ug/kg	
Indeno(1, 2, 3-cd)Pyrene		91U	ug/kg		Surrog: 2-Fluorobiphenol+			40 %	% Recov		PCB - 1232			10U	ug/kg	
Benzo(b)fluoranthene		39J*	ug/kg		Surrog: 2-Naphthoic ac+			64 %	% Recov		PCB - 1248			10U	ug/kg	
Fluoranthene		840 *	ug/kg		Surrog: D5-Nitrobenzene			28 %	% Recov		PCB - 1016			10U	ug/kg	
Benzo(k)fluoranthene		91U	ug/kg		Surrog: D5-Phenol			82 %	% Recov		beta-Endosulfan			10U	ug/kg	
Acenaphthylenc		8J*	ug/kg		Surrog: o-Methylpodoc+			64 %	% Recov		PCB - 1242			10U	ug/kg	
Chrysene		57J*	ug/kg		Int Std: Hexabromobenz+									9.2 %	% Recov	
Retene		120 *	ug/kg		Misc GC Specified											
4, 6-Dinitro-2-methylph+		440U	ug/kg													
1, 3-Dichlorobenzene		91U	ug/kg		Sediment											
2, 6-Dinitrotoluene		91U	ug/kg		Result											
N-Nitroso-di-n-Propyla+		91U	ug/kg		Units											
4-Chlorophenyl-phenyle+		91U	ug/kg													
bis(2-Chloroisopropyl)+		91U	ug/kg													
Surrog: D10-Byrene		127 %	% Recov													
Surrog: 2-Fluorobiphen+		74 %	% Recov													
Surrog: 2-Fluorophenol		55 %	% Recov													
Surrog: D14-Terphenyl		135 %	% Recov													
Surrog: D5-Nitrobenzene		46 %	% Recov													
Surrog: D5-Phenol		59 %	% Recov													

(Sample Complete)

Project: DOE-541F GRAYS HARBOR SALMON SURVEY

Laboratory: Ecology, Manchester

Sample No: 88 228135 Description: AT WEYCO (D)

Begin Date: 88/05/23 :

Gen Inorg/Phys-Speci		Sediment	VOA - PP Scan (GCMS)	Sediment	VOA - PP Scan (GCMS)	Sediment	VOA - PP Scan (GCMS)	Sediment	VOA - PP Scan (GCMS)	Sediment
Metals - PP	Sediment	Result Units	Result Units	Result Units	Result Units	Result Units	Result Units	Result Units	Result Units	Result Units
Cyanide	Sedmt	0.03U	mg/kg-dr							
Arsenic	As-Sedmt	3.4 *	mg/kg-dr	1,1-Dichloroethane	6U	ug/kg	2,2-Dichloropropane	6U	ug/kg	13U ug/kg
Lead	Pb-Sedmt	1.8 *	mg/kg-dr	1,1,1,2-Tetrachloroethene	6U	ug/kg	2-Hexanone	6U	ug/kg	6U ug/kg
Silver	Ag-Sedmt	0.02U	mg/kg-dr	Trichlorofluoromethane	6U	ug/kg	Ethane, 1,1,1,2-Tetrachloroethene	6U	ug/kg	6U ug/kg
Antimony	Sb-Sedmt	0.1U	mg/kg-dr	1,2-Dichloropropane	13U	ug/kg	cis-1,3-Dichloropropene	6U	ug/kg	6U ug/kg
Thallium	Tl-Sedmt	1.3 *	mg/kg-dr	2-Butanone	13U	ug/kg	cis-1,3-Dichloropropene	6U	ug/kg	6U ug/kg
Mercury	Hg-Sedmt	0.031 *	mg/kg-wt	2-Trichloroethene	13U	ug/kg	Surrog: D4-1,2-Dichloroethene	106%	% Recov	106% % Recov
Metals - ICP Scan		Total Xylenes								
Beryllium	Be-Sedmt	0.9 *	mg/kg-dr	1,2-Chlorotoluene	6U	ug/kg	Surrog: D8-Toluene	89%	% Recov	89% % Recov
Cadmium	Cd-Sedmt	0.5U	mg/kg-dr	1,2,4-Trimethylbenzene	6U	ug/kg	Surrog: D8-Toluene	98%	% Recov	98% % Recov
Chromium	Cr-Sedmt	27.9 *	mg/kg-dr	DBCP	6U	ug/kg	Benzo(a)anthracene	77U	ug/kg	370U ug/kg
Copper	Cu-Sedmt	4.0 *	mg/kg-dr	1,2,3-Trichloropropane	6U	ug/kg	Benzo(a)anthracene	77U	ug/kg	23J*
Lead	Pb-Sedmt	4.9 *	mg/kg-dr	Tert-Butylbenzene	6U	ug/kg	4-Chloro-3-Methylphenol	77U	ug/kg	77U ug/kg
Nickel	Ni-Sedmt	62.5 *	mg/kg-dr	Isopropylbenzene (Cumene)	6U	ug/kg	Benzoic acid	370U	ug/kg	370U ug/kg
Zinc	Zn-Sedmt	73. *	mg/kg-dr	P-Isopropyltoluene	6U	ug/kg	Hexachloroethane	77U	ug/kg	77U ug/kg
Tin	Sn-Sedmt	105. *	mg/kg-dr	Ethylbenzene	6U	ug/kg	Hexachlorocyclopentadiene	150U	ug/kg	150U ug/kg
VOA - PP Scan (GCMS)		Styrene								
Carbon Tetrachloride	Sediment	1,4-Dichlorobenzene								
Acetone	Result	1,2-Dibromoethane (EDB)								
Chloroform	Result	1,2-Dichloroethane								
Benzene	Result	Vinyl Acetate								
1,1,1-Trichloroethane	Result	4-Methyl-2-Pentanone								
Bromomethane	6U	ug/kg	1,3,5-Trimethylbenzene							
Chloromethane	8U	ug/kg	Bromobenzene							
Dibromomethane	6U	ug/kg	Toluene							
Chloroethane	13U	ug/kg	Chlorobenzene							
Vinyl Chloride	13U	ug/kg	1,2,4-Trichlorobenzene							
Methylene Chloride	4U	ug/kg	Dibromochloromethane							
Carbon Disulfide	6U	ug/kg	Tetrachloroethene							
Bromoform	6U	ug/kg	Sec-Butylbenzene							
Bromodichloromethane	6U	ug/kg	1,3-Dichloropropane							
			Cis-1,2-Dichloroethene							
			trans-1,2-Dichloroethene							
			1,3-Dichlorobenzene							
			1,1-Dichloropropane							

Source: Sediment (General)

Officer: DXR Account: 41652

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Project: DOE-541F GRAYS HARBOR SALMON SURVEY

Officer: DXR Account: 41652

Laboratory: Ecology, Manchester

Sample No: 88 228135 Description: AT WEYCO (D)

Begin Date: 88/05/23 :

Source: Sediment (General)

B/N/Acid Scan	Continued	Sediment		Resin Acids Guaiacol		Sediment Result		Pest/PCB		PP Scan		Sediment Result	
		Result	Units			Result	Units						
Nitrobenzene		77U	ug/kg	Linoleic acid		170J*	ug/kg	4,4'-DDT				1U	ug/kg
3-Nitroaniline		370U	ug/kg	Guaiacol (2-methoxyphen+ 4-Allylguaiacol (eugen+		77U	ug/kg	Chlordane				1U	ug/kg
4-Nitroaniline		370U	ug/kg	Oleic acid		510J*	ug/kg	gamma-BHC (Lindane)				1U	ug/kg
4-Nitropheno1		370U	ug/kg	Sandaracopimaric acid		77U	ug/kg	Diehrin				1U	ug/kg
Benzyl Alcohol		77U	ug/kg	Abietic acid		29J*	ug/kg	Endrin				1U	ug/kg
4-Bromophenyl-phenylet+		77U	ug/kg	Tetrachloroguaicolic acid		77U	ug/kg	4,4'-DDD				1U	ug/kg
2, 4-Dimethylphenol		77U	ug/kg	4,5,6-Trichloroguaicolic acid		77U	ug/kg	Heptachlor				1U	ug/kg
4-Methylphenol		77U	ug/kg	9,10-Dichlorosteric acid		77U	ug/kg	Aldrin				1U	ug/kg
1, 4-Dichlorobenzene		77U	ug/kg	Dichlorodehydroabietic acid		77U	ug/kg	alpha-BHC				1U	ug/kg
4-Chloroaniline		77U	ug/kg	Dehydroabietic acid		170JB*	ug/kg	beta-BHC				1U	ug/kg
Phenol		77U	ug/kg	4,5-Dichloroguaicolic acid		77U	ug/kg	delta-BHC				1U	ug/kg
bis(2-Chloroethoxy)Ether		77U	ug/kg	Trichlorosyringol		77U	ug/kg	alpha-Endosulfan				1U	ug/kg
bis(2-Chloroethoxy)Met+		77U	ug/kg	Isopimaric acid		77U	ug/kg	Heptachlor epoxide				1U	ug/kg
BIS(2-ETHYLHEXYL) PHTH+		270B*	ug/kg	4-Chloroguaicolic acid		77U	ug/kg	Endosulfan sulfate				1U	ug/kg
Di-n-Octyl Phthalate		46BJ*	ug/kg	Surrog: Pyrene D10		51%	% Recov	Endrin aldehyde				1U	ug/kg
Hexachlorobenzene		77U	ug/kg	Surrog: 2-Fluoro, 1-methyl Hexachlorobenzene		NAR	% Recov	Toxaphene				1U	ug/kg
Anthracene		77U	ug/kg	Surrog: 2-Fluorobiphenyl		40%	% Recov	PCB -	1260			10U	ug/kg
1, 2, 4-Trichlorobenzene		77U	ug/kg	Surrog: 2-Fluorophenol		23%	% Recov	PCB -	1254			10U	ug/kg
2, 4-Dichloropheno1		77U	ug/kg	Surrog: Heptadecanoic acid		92	% Recov	PCB -	1221			10U	ug/kg
2, 4-Dinitrotoluene		77U	ug/kg	Surrog: D14-Terphenyl		43%	% Recov	PCB -	1232			10U	ug/kg
Pyrene		120*	ug/kg	Surrog: 2-Naphthoic acid		71	% Recov	PCB -	1248			10U	ug/kg
Dimethylphthalate		77U	ug/kg	Surrog: D5-Nitrobenzene		22%	% Recov	PCB -	1016			1U	ug/kg
Dibenzofuran		19J*	ug/kg	Surrog: D5-Phenol		70%	% Recov	Dimethylsulfan				10U	ug/kg
Benzo(ghi)perylene		77U	ug/kg	Surrog: o-Methylpodocaa+		70	% Recov	PCB -	1242			10U	ug/kg
Indeno(1,2,3-cd)pyrene		77U	ug/kg					IntStd: Hexabromobenzene				10U	% Recov
Benzo(b)fluoranthene		20J*	ug/kg									10U	
Fluoranthene		100*	ug/kg									10U	
Benzo(k)fluoranthene		77U	ug/kg									10U	
Acenaphthylene		4J*	ug/kg									10U	
Chrysene		77U	ug/kg									10U	
Retene		64J*	ug/kg									10U	
4, 6-Dinitro-2-methylph+		370U	ug/kg									10U	
1, 3-Dichlorobenzene		77U	ug/kg									10U	
2, 6-Dinitrotoluene		77U	ug/kg									10U	
N-Nitroso-di-n-Propyl-		77U	ug/kg									10U	
4-Chlorophenyl-phenyle+		77U	ug/kg									10U	
bis(2-Chloroisopropyl)+		77U	ug/kg									10U	
Surrog: D10-Pyrene		89%	% Recov									10U	
Surrog: 2-Fluorobiphenyl		58%	% Recov									10U	
Surrog: D14-Terphenyl		31%	% Recov									10U	
Surrog: D5-Nitrobenzene		34%	% Recov									10U	
Surrog: D5-Phenol		40%	% Recov									10U	

(Sample Complete)

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Laboratory: Ecology, Manchester

Sample No: 88 228136 Description: BW WEYCO

Begin Date: 88/05/23 :

		Gen Inorg/Phys-Speci		Sediment		VOA - PP Scan (GCMS)		Sediment		VOA - PP Scan (GCMS)		Sediment	
		Result	Units	Result	Units	***	Continued ***	Result	Units	***	Continued ***	Result	Units
Cyanide	Sedmt	0.04U	mg/kg-dr	1,1-Dichloroethane	9U	ug/kg	2,2-Dichloropropane	9U	ug/kg	2-Hexanone	17U	ug/kg	
Metals - PP				1,1-Dichloroethene	9U	ug/kg	Ethane, 1,1,1,2-Tetrachloroethane	9U	ug/kg	cis-1,3-Dichloropropene	9U	ug/kg	
				Methane, Dichlorodifluoromethane	17U	ug/kg	cis-1,3-Dichloropropene	9U	ug/kg	trans-1,3-Dichloropropene	9U	ug/kg	
				1,2-Dichloropropane	9U	ug/kg	Surrog: D4-1,2-Dichloroethane	98%	% Recov				
Arsenic	As-Sedmt	3.8 *	mg/kg-dr	2-Butanone	2U	ug/kg	Surrog: 1,4-Bromofluorobutane	78%	% Recov				
Lead	Pb-Sedmt	3.2 *	mg/kg-dr	1,1,2-Trichloroethane	9U	ug/kg	Surrog: D8-Toluene	105%	% Recov				
Silver	Ag-Sedmt	0.02U	mg/kg-dr	Trichloroethene	9U	ug/kg							
Antimony	Sb-Sedmt	0.1U	mg/kg-dr	1,1,2,2-Tetrachloroethane	9U	ug/kg							
Selenium	Se-Sedmt	0.9 *	mg/kg-dr	1,2,3-Trichlorobutene	9U	ug/kg							
Thorium	Tl-Sedmt	0.1U	mg/kg-dr	Hexachlorobutadiene	9U	ug/kg							
Mercury	Hg-Sedmt	0.048 *	mg/kg-wt	Naphthalene	9U	ug/kg							
				Total Xylenes	9U	ug/kg							
Metals - ICP Scan				2-Chlorotoluene	9U	ug/kg							
Beryllium	Be-Sedmt	1.1 *	mg/kg-dr	1,2-Dichlorobenzene	9U	ug/kg							
Cadmium	Cd-Sedmt	0.5U	mg/kg-dr	1,2,3-Trichlorobenzene	9U	ug/kg							
Chromium	Cr-Sedmt	28.7 *	mg/kg-dr	Tert-Butylbenzene	9U	ug/kg							
Copper	Cu-Sedmt	51.5 *	mg/kg-dr	Isopropylbenzene (Cumene)	9U	ug/kg							
Lead	Pb-Sedmt	6.7 *	mg/kg-dr	P-Isopropyltoluene	9U	ug/kg							
Nickel	Ni-Sedmt	57.5 *	mg/kg-dr	Styrene	9U	ug/kg							
Zinc	Zn-Sedmt	77.1 *	mg/kg-dr	Benzene, Propyl-	9U	ug/kg							
Tin	Sn-Sedmt	101. *	mg/kg-dr	Butylbenzene	9U	ug/kg							
				4-Chlorotoluene	9U	ug/kg							
				4,4-Dichlorobenzene	9U	ug/kg							
				1,2-Dibromoethane (EDB)	17U	ug/kg							
				1,2-Dichloroethane	9U	ug/kg							
				Vinyl Acetate	17U	ug/kg							
Carbon Tetrachloride				4-Methyl-2-Pentanone	17U	ug/kg							
Acetone				1,3,5-Trimethylbenzene	9U	ug/kg							
				Bromobenzene	0.3U	ug/kg							
				Toluene	9U	ug/kg							
				Chlorobenzene	9U	ug/kg							
				4,4-Dichlorobenzene	9U	ug/kg							
				1,2,4-Trichlorobenzene	9U	ug/kg							
				Dibromochloromethane	9U	ug/kg							
				Tetrachloroethene	9U	ug/kg							
				Sec-Butylbenzene	9U	ug/kg							
				1,3-Dichlorobenzene	9U	ug/kg							
				1,2,4-Trichlorobenzene	17U	ug/kg							
				Dibromobutadiene	9U	ug/kg							
				NaPhthalene	0.3U	ug/kg							
				Total Xylenes	9U	ug/kg							
				2-Chlorotoluene	9U	ug/kg							
				Cis-1,2-Dichloroethene	9U	ug/kg							
				trans-1,2-Dichloroethene	2U	ug/kg							
				1,3-Dichlorobenzene	9U	ug/kg							
				1,1-Dichloropropane	9U	ug/kg							
				Methylene Chloride	7U	ug/kg							
				Carbon Disulfide	2U	ug/kg							
				Bromoform	9U	ug/kg							
				Bromodichloromethane	9U	ug/kg							

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Project: DOE-541F GRAYS HARBOR SALMON SURVEY

Officer: DXR Account: 41652

Laboratory: Ecology, Manchester

Sample No: 88 228136 Description: BW WEYCO

Begin Date: 88/05/23 :

VOA - PP Scan (GCMS)		Sediment		VOA - PP Scan (GCMS)		Sediment		VOA - PP Scan (GCMS)		Sediment	
*** Continued		Result		Matrix Spike #2		Continued		Matrix Spike #2		Continued	
Matrix Spike #1		Units		Result		Units		Result		Units	
1, 2, 3-Trichloropropane	76.4	% Recov	1,1,1-Trichloroethane	77.8	% Recov	Chlorobenzene	94.7	% Recov			
Tert-Butylbenzene	75.1	% Recov	Bromomethane	86.9	% Recov	1,2,4-Trichlorobenzene	30.3J	% Recov			
Isopropylbenzene (Cume+)	84.1	% Recov	Chloromethane	103	% Recov	Dibromochloromethane	70.9	% Recov			
p-Isopropyltoluene	65.5	% Recov	Dibromomethane	74.8	% Recov	Tetrachloroethene	90.4	% Recov			
Ethylbenzene	91.4	% Recov	Chloroethane	89.0	% Recov	Sec-Butylbenzene	69.6	% Recov			
Styrene	81.9	% Recov	Vinyl Chloride	93.2	% Recov	1,3-Dichloropropane	77.5	% Recov			
Benzene, Propyl-	77.0	% Recov	Methylene Chloride	111.5	% Recov	Cis-1,2-Dichloroethene	99.8	% Recov			
Butylbenzene	53.5	% Recov	Carbon Disulfide	99.2	% Recov	trans-1,2-Dichloroethene	94.7	% Recov			
4-Chlorotoluene	76.7	% Recov	Bromoform	58.9	% Recov	1,3-Dichlorobenzene	65.8J	% Recov			
1, 4-Dichlorobenzene	67.4J	% Recov	Bromodichloromethane	81.1	% Recov	1,1-Dichloropropane	76.6	% Recov			
1, 2-Dibromoethane (EDB)	77.8	% Recov	1,1-Dichloroethane	99.9	% Recov	2-Dichloropropane	96.9	% Recov			
1, 2-Dichloroethane	93.3	% Recov	1,1-Dichloroethene	89.8	% Recov	2-Hexanone	79.8	% Recov			
Vinyl Acetate	65.7	% Recov	Trichlorofluoromethane	84.7	% Recov	Ethane, 1,1,1,2-Tetrac+	90.2	% Recov			
4-Methyl-1-2-Pentanone	93.8	% Recov	Methane, Dichlorodiflu+	88.9	% Recov	cis-1,3-Dichloropropene	74.4	% Recov			
1, 3, 5-Trimethylbenzene	75.9	% Recov	1,2-Dichloropropane	82.6	% Recov	trans-1,3-Dichloroprop+	70.2	% Recov			
Bromobenzene	79.6	% Recov	2-Butanone	78.3	% Recov	Surrog: D4-1,2-Dichlor+	105	% Recov			
Toluene	98.2	% Recov	1,1,2-Trichloroethane	76.6	% Recov	Surrog: 1,4-Bromofluor+	88	% Recov			
Chlorobenzene	94.4	% Recov	Trichloroethene	68.7	% Recov	Surrog: D8-Toluene	106	% Recov			
1, 2, 4-Trichlorobenzene	31.4J	% Recov	1,1,1,2,2-Tetrachloroeth+	60.5	% Recov	+-----					
Dibromoethane	77.9	% Recov	1,2,3-Trichlorobenzene	22.8	% Recov	+-----					
Tetrachloroethene	83.9	% Recov	Hexachlorobutadiene	24.9J	% Recov	+-----					
Sec-Butylbenzene	68.3	% Recov	Naphthalene	26.1J	% Recov	+-----					
1, 3-Dichloropropane	85.3	% Recov	Total Xylenes	9.1	% Recov	+-----					
Cis-1, 2-Dichloroethene	91.8	% Recov	2-Chlorotoluene	79.9	% Recov	Benzo(a)Pyrene	100U	ug/kg			
trans-1, 2-Dichloroethene	88.2	% Recov	1,2-Dichlorobenzene	60.4J	% Recov	2,4-Dinitrophenol	480U	ug/kg			
1, 3-Dichlorobenzene	67.1J	% Recov	1,2,4-Trimethylbenzene	75.7	% Recov	Dibenzo(a,h)anthracene	100U	ug/kg			
1, 1-Dichloropropane	79.4	% Recov	DBCP	50.2	% Recov	Benzo(a)anthracene	23J*	ug/kg			
2, 2-Dichloropropane	75.5	% Recov	1, 2, 3-Trichloropropane	75.1	% Recov	4-Chloro-3-Methylphenol	100U	ug/kg			
2-Hexanone	85.6	% Recov	Tert-Butylbenzene	75.2	% Recov	Benzoic acid	480U	ug/kg			
Ethane, 1, 1, 2-Tetrac+	91.9	% Recov	Isopropylbenzene (Cum+	87.7	% Recov	Hexachloroethane	100U	ug/kg			
cis-1, 3-Dichloropropane	76.6	% Recov	p-Isopropyltoluene	67.5	% Recov	Hexachlorocyclopentadi+	200U	ug/kg			
trans-1, 3-Dichloropropane	74.0	% Recov	Ethylbenzene	94.6	% Recov	Isophorone	100U	ug/kg			
Surrog: D4-1,2-Dichlor+	100B	% Recov	Styrene	79.6	% Recov	Acenaphthene	24J*	ug/kg			
Surrog: 1,4-Bromofluor+	88B	% Recov	Benzene, Propyl-	78.0	% Recov	Diethylphthalate	100BU	ug/kg			
Surrog: D8-Toluene	100B	% Recov	Butylbenzene	53.8	% Recov	Di-n-Butylphthalate	35BJ*	ug/kg			
			4-Chlorotoluene	71.9	% Recov	Phenanthrene	120*	ug/kg			
			1, 4-Dichlorobenzene	63.1J	% Recov	Butylbenzylphthalate	100BU	ug/kg			
			1, 2-Dibromoethane (EDB)	70.4	% Recov	N-Nitrosodiphenylamine	12J*	ug/kg			
Carbon Tetrachloride	73.8	% Recov	1, 2-Dichloroethane	96.9	% Recov	Carbazole	27J*	ug/kg			
Acetone	101	% Recov	Vinyl Acetate	53.9	% Recov	Fluorene	190U	ug/kg			
Chloroform	99.7	% Recov	4-Methyl-2-Pentanone	96.5	% Recov	Hexachlorobutadiene	100U	ug/kg			
Benzene	84.0	% Recov	1, 3, 5-Trimethylbenzene	75.7	% Recov	Pentachlorophenol	480U	ug/kg			
			Bromobenzene	78.5	% Recov	2, 4, 6-Trichlorophenol	100U	ug/kg			
			Toluene	102	% Recov	2-Nitroaniline	480U	ug/kg			

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Project: DOE-541F GRAYS HARBOR SALMON SURVEY

Laboratory: Ecology, Manchester

Sample No: 88 228136

Description: BW WEYCO

Begin Date: 88/05/23 :

B/N/Acid Scan		Sediment		B/N/Acid Scan		Sediment		Sediment		Sediment	
*** Continued		Result		*** Continued		Result		Result		Result	
		Units	Units			Units	Units	Units	Units	Units	Units
2-Nitrophenol	10.0U	ug/kg	N-Nitroso-di-n-Propyl +	100U	ug/kg					230U	ug/kg
Naphthalene, 1-Methyl-	10.0U	ug/kg	4-Chlorophenyl-phenyle +	100U	ug/kg					120U	ug/kg
Naphthalene	8.7BJ*	ug/kg	bis(2-Chloroisopropyl) +	100U	ug/kg					120U	ug/kg
2-Methylnaphthalene	1.9J*	ug/kg	Surrog: D10-Pyrene	65%	% Recov					46U	ug/kg
2-Chloronaphthalene	10.0U	ug/kg	Surrog: 2-Fluorobiphen +	71%	% Recov					46U	ug/kg
3,3,-Dichlorobenzidine	10.0U	ug/kg	Surrog: 2-Fluorophenol	61%	% Recov					23U	ug/kg
2-Methylphenol	10.0U	ug/kg	Surrog: D14-Terphenyl	103%	% Recov					120U	ug/kg
1,2-Dichlorobenzene	10.0U	ug/kg	Surrog: D5-Nitrobenzene	50%	% Recov					23U	ug/kg
o-Chlorophenol	10.0U	ug/kg	Surrog: D5-Phenol	68%	% Recov						
2,4,5-Trichlorophenol	4.80U	ug/kg									
Nitrobenzene	10.0U	ug/kg									
3-Nitroaniline	4.80U	ug/kg									
4-Nitroaniline	4.80U	ug/kg									
4-Nitrophenol	4.80U	ug/kg									
Benzyl Alcohol	10.0U	ug/kg	Linoleic acid	540J*	ug/kg					1U	ug/kg
4-Bromophenyl-Phenylet +	10.0U	ug/kg	Guaiacol (2-methoxyphen +	100U	ug/kg					1U	ug/kg
2,4-Dimethylphenol	10.0U	ug/kg	4-Allylguaiacol (eugen +	100U	ug/kg					1U	ug/kg
4-Methylphenol	520*	ug/kg	Oleic acid	800J*	ug/kg					1U	ug/kg
1,4-Dichlorobenzene	10.0U	ug/kg	Sandaracopimaric acid	100U	ug/kg					1U	ug/kg
4-Chloroaniline	10.0U	ug/kg	Abietic acid	1300J*	ug/kg					1U	ug/kg
Phenol	24.BJ*	ug/kg	Tetrachloroguaiccol	100U	ug/kg					1U	ug/kg
bis(2-Chloroethyl)Ether	10.0U	ug/kg	4,5,6-Trichloroguaiccol	100U	ug/kg					1U	ug/kg
bis(2-Chloroethoxy)Met +	10.0U	ug/kg	9,10-Dichlorosteric ac +	100U	ug/kg					1U	ug/kg
BIS (2-ETHYLHEXYL) PHTH +	4.6BJ*	ug/kg	Dichlorodehydroabietic +	100U	ug/kg					1U	ug/kg
Di-n-Octyl Phthalate	10.0BU	ug/kg	Dehydroabietic acid	400JB*	ug/kg					1U	ug/kg
Hexachlorobenzene	10.0U	ug/kg	4,5-Dichloroguaiccol	100U	ug/kg					1U	ug/kg
Anthracene	1.5J*	ug/kg	Trichlorosyringol	100U	ug/kg					1U	ug/kg
1,2,4-Trichlorobenzene	10.0U	ug/kg	Isopimaric acid	100U	ug/kg					1U	ug/kg
2,4-Dichlorophenol	10.0U	ug/kg	4-Chloroguaiccol	100U	ug/kg					1U	ug/kg
2,4-Dinitrotoluene	1.0U	ug/kg	Endrin aldehyde	30U	ug/kg					30U	ug/kg
Pyrene	1.20*	ug/kg	Toxaphene	10U	ug/kg					10U	ug/kg
Dimethylphthalate	1.00U	ug/kg	Surrog: Pyrene D10	26%	% Recov					10U	ug/kg
Dibenzofuran	21J*	ug/kg	Surrog: 2-Fluoro-1-met +	32%	% Recov					10U	ug/kg
Benzo(ghi)perylene	1.00U	ug/kg	Surrog: 2-Fluorobiphen +	42%	% Recov					10U	ug/kg
Indeno(1,2,3-cc)Pyrene	1.00U	ug/kg	Surrog: Hepta-decanoic +	104%	% Recov					10U	ug/kg
Benzo(b)fluoranthene	1.00U	ug/kg	Surrog: D14-Terphenyl	38%	% Recov					10U	ug/kg
Fluoranthene	8.8J*	ug/kg	Surrog: 2-Naphthoic ac +	79%	% Recov					10U	ug/kg
Benzo(k)fluoranthene	1.00U	ug/kg	Surrog: D5-Nitrobenzene	25%	% Recov					10U	ug/kg
Acenaphthyl	1.13J*	ug/kg	Surrog: D5-Phenol	107%	% Recov					10U	ug/kg
Chrysene	1.8J*	ug/kg	Surrog: o-Methylpodocat +	63%	% Recov					73%	% Recov
Retene	1.50*	ug/kg									
4,6-Dinitro-2-methylph +	4.80U	ug/kg									
1,3-Dichlorobenzene	1.00U	ug/kg									
2,6-Dinitrotoluene	1.00U	ug/kg									

(Sample Complete)

Source: Sediment (General)

Officer: DXR

Account: 41652

Project: DOE-541F GRAYS HARBOR SALMON SURVEY

Officer: DXR Account: 41652

Laboratory: Ecology, Manchester

Sample No: 88 228137

Description: AT ITT RAYONIER

Begin Date: 88/05/23 :

End Date:

88/05/23 :

Source: Sediment (General)

Gen Inorg/Phys-Speci		Sediment	VOA - PP Scan (GCMS)	Sediment	VOA - PP Scan (GCMS)	Sediment
Metals - PP		Sediment	Result Units	*** Continued	*** Continued	*** Continued
Cyanide	Sedmt	0.05U mg/kg-dr				
1,1-Dichloroethane			1.0U ug/kg	2,2-Dichloropropane	1.0U ug/kg	
1,1-Dichlorofluoromethane			1.0U ug/kg	2-Hexanone	2.0U ug/kg	
Methane, Dichlorodiflu+			2.0U ug/kg	Ethane, 1,1,1,2-Tetrac+	1.0U ug/kg	
				cis-1,3-Dichloropropene	1.0U ug/kg	
1,2-Dichloropropane			1.0U ug/kg	trans-1,3-Dichloroprop+	1.0U ug/kg	
2-Butanone			9.0U ug/kg	Surrog: D4-1,2-Dichlor+	100% % Recov	
				Surrog: 1,4-Bromofluor+	8.2% % Recov	
1,2-Trichloroethane			1.0U ug/kg	Surrog: D8-Toluene	106% % Recov	
Trichloroethene						
1,1,2,2-Tetrachloroeth+			1.0U ug/kg			
1,2,3-Trichlorobenzene			1.0U ug/kg			
Hexachlorobutadiene			1.0U ug/kg			
Naphthalene			1.0U ug/kg			
Total Xylenes			1.0U ug/kg			
2-Chlorotoluene			1.0U ug/kg	Benzo(a)Pyrene	120U ug/kg	
				2,4-Dinitrophenol	600U ug/kg	
				Dibenzo(a,h)anthracene	120U ug/kg	
				Benzo(a)anthracene	120U ug/kg	
Beryllium	Be-Sedmt	1. * mg/kg-dr	1.0U ug/kg	4-Chloro-3-MethylPhenol	120U ug/kg	
Cadmium	Cd-Sedmt	0.5U mg/kg-dr	1.0U ug/kg	Benzoic acid	600U ug/kg	
Chromium	Cr-Sedmt	30.7 * mg/kg-dr	1.0U ug/kg	Hexachloroethane	120U ug/kg	
COPPER	Cu-Sedmt	52. * mg/kg-dr	1.0U ug/kg	Hexachlorocyclopentadi+	250U ug/kg	
Lead	Pb-Sedmt	5. * mg/kg-dr	1.0U ug/kg	Isophorone	120U ug/kg	
Nickel	Ni-Sedmt	55.4 * mg/kg-dr	1.0U ug/kg	Acenaphthene	120U ug/kg	
Zinc	Zn-Sedmt	77.1 * mg/kg-dr	1.0U ug/kg	Diethylbutylphthalate	120BU ug/kg	
Tin	Sn-Sedmt	104. * mg/kg-dr	1.0U ug/kg	Di-n-Butylphthalate	27BJ * ug/kg	
				Phenanthrene	110J * ug/kg	
				Butylbenzylphthalate	120BU ug/kg	
				N-Nitrosodiphenylamine	120U ug/kg	
				Carbazole	18J * ug/kg	
VOA - PP Scan (GCMS)		Sediment	Result Units			
Carbon Tetrachloride			1.0U ug/kg	4-Methyl-2-Pentanone	2.0U ug/kg	
Acetone			2.9U ug/kg	1,3,5-Trimethylbenzene	1.0U ug/kg	
Chloroform			1.0U ug/kg	Bromobenzene	1.0U ug/kg	
				Toluene	0.7U ug/kg	
Benzene			1.0U ug/kg	Chlorobenzene	1.0U ug/kg	
1,1,1-Trichloroethane			1.0U ug/kg	1,2,4-Trichlorobenzene	1.0U ug/kg	
Bromomethane			2.0U ug/kg	Dibromochloromethane	1.0U ug/kg	
Chloromethane			1.0U ug/kg	Tetrachloroethene	1.0U ug/kg	
Dibromomethane			1.0U ug/kg	Sec-Butylbenzene	1.0U ug/kg	
Chloroethane			2.0U ug/kg	1,3-Dichloropropane	1.0U ug/kg	
Vinyl Chloride			5.0 ug/kg	Cis-1,2-Dichloroethene	1.0U ug/kg	
Methylene Chloride			1.0U ug/kg	trans-1,2-Dichloroethene	1.0U ug/kg	
Carbon Disulfide			1.0U ug/kg	1,3-Dichlorobenzene	1.0U ug/kg	
Bromoform			1.0U ug/kg	o-Chlorophenol	1.0U ug/kg	
Bromodichloromethane			1.0U ug/kg	2,4,5-Trichlorophenol	600U ug/kg	

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Washington State Department of Ecology
Sample/Project Analysis Results

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Project: DOE-541F GRAYS HARBOR SALMON SURVEY

Laboratory: Ecology, Manchester

Sample No: 88 228137

Description: AT ITT RAYONIER

Begin Date: 88/05/23 :

B/N/Acid Scan	Sediment	Resin Acids	Guaiacol	Sediment Result	PP Scan	Sediment Result	Units
*** Continued	Result Units						
Nitrobenzene	120U ug/kg	Linoleic acid	740 *	ug/kg	4,4'-DDT	1U ug/kg	
3-Nitroaniline	600U ug/kg	Guaicol (2-methoxyphen+ 4-Allylguaiacol (eugen+	19J*	ug/kg	Chlordane	1U ug/kg	
4-Nitroaniline	600U ug/kg	Oleic acid	1600J*	ug/kg	gamma-BHC (Lindane)	1U ug/kg	
4-Nitrophenol	600U ug/kg	Sandaracopimaric acid	120U ug/kg	ug/kg	Dieldrin	1U ug/kg	
Benzyl Alcohol	120U ug/kg	Abietic acid	120U ug/kg	ug/kg	Endrin	1U ug/kg	
4-Bromophenyl-phenylet+	120U ug/kg	Tetrachloroguaiacl	120U ug/kg	ug/kg	4,4'-DDE	1U ug/kg	
2,4-Dimethylphenol	120U ug/kg	4,5,6-Trichloroquaicoll	90J*	ug/kg	Heptachlor	1U ug/kg	
4-Methylphenol	120U ug/kg	9,10-Dichloroetric ac+	120U ug/kg	ug/kg	Aldrin	1U ug/kg	
1,4-Dichlorobenzene	120U ug/kg	9,10-Dichlorodehydroabietic+	72J*	ug/kg	alpha-BHC	1U ug/kg	
4-Chloroaniline	120U ug/kg	Dehydroabietic acid	330JB*	ug/kg	beta-BHC	1U ug/kg	
Phenol	120BU ug/kg	4,5-Dichloroguaiacl	120U ug/kg	ug/kg	delta-BHC	1U ug/kg	
bis(2-Chloroethyl)Ether	120U ug/kg	Trichlorosyringol	120U ug/kg	ug/kg	alpha-Endosulfan	1U ug/kg	
bis(2-Chloroethoxy)Met+	120U ug/kg	Isopimaric acid	120U ug/kg	ug/kg	Heptachlor epoxide	1U ug/kg	
BIS(2-ETHYLHEXYL) PHTH+	170B* ug/kg	4-Chloroguaiacl	120U ug/kg	ug/kg	Endosulfan sulfate	1U ug/kg	
Di-n-Octyl Phthalate	120BU ug/kg	Surrog: Pyrene D10	41%	% Recov	Endrin aldehyde	1U ug/kg	
Hexachlorobenzene	120U ug/kg	Surrog: 2-Fluoro,1-met+	42%	% Recov	Toxaphene	30U ug/kg	
Anthracene	120U ug/kg	Surrog: 2-Fluorobiphen+	173%	% Recov	PCB - 1260	10U ug/kg	
1,2,4-Trichlorobenzene	120U ug/kg	Surrog: 2-Fluorophenol	14%	% Recov	PCB - 1254	10U ug/kg	
2,4-Dichlorophenol	120U ug/kg	Surrog: Heptadecanoic +	78	% Recov	PCB - 1221	10U ug/kg	
2,4-Dinitrotoluene	120U ug/kg	Surrog: DI-4-Terphenyl	40%	% Recov	PCB - 1232	10U ug/kg	
Pyrene	140 * ug/kg	Surrog: 2-Naphthoic ac+	42	% Recov	PCB - 1248	10U ug/kg	
Dimethylphthalate	120U ug/kg	Surrog: D5-Nitrobenzene	23%	% Recov	PCB - 1016	10U ug/kg	
Dibenzofuran	117J* ug/kg	Surrog: D5-Phenol	66%	% Recov	beta-Endosulfan	1U ug/kg	
Benzo(ghi)perylene	120U ug/kg	Surrog: o-Methylpodoca+	65	% Recov	PCB - 1242	10U ug/kg	
Indeno(1,2,3-cd)pyrene	120U ug/kg				Int Std: Hexabromobenzene	108%	% Recov
Benzo(b)fluoranthene	120U ug/kg						
Fluoranthene	120J* ug/kg	Misc GC Specified					
Benzo(k)fluoranthene	120U ug/kg						
Acenaphthylene	120U ug/kg						
Chrysene	120U ug/kg	Aldicarb	280U ug/kg				
Retene	370 * ug/kg	Simazine	140U ug/kg				
4,6-Dinitro-2-methylph+	600U ug/kg	Diuron	140U ug/kg				
1,3-Dichlorobenzene	120U ug/kg	Atrazine	56U ug/kg				
2,6-Dinitrotoluene	120U ug/kg	Butylate	56U ug/kg				
N-Nitroso-di-n-Propyl-	120U ug/kg	Metribuzin	56U ug/kg				
4-Chlorophenyl-phenyle+	120U ug/kg	Fenamiphos	28U ug/kg				
bis(2-Chloroisopropyl)+	120U ug/kg	Pronamide	140U ug/kg				
Surrog: D10-Pyrene	93%	Hexazinone	28U ug/kg				
surrog: 2-Fluorobiphen+	39%						
Surrog: 2-Fluorophenol	25%						
Surrog: D14-Terphenyl	101%						
Surrog: D5-Nitrobenzene	20%						
Surrog: D5-Phenol	27%						

Source: Sediment (General)

Officer: DXR Account: 41652

Project: DOE-541F GRAYS HARBOR SALMON SURVEY

Officer: DXR Account: 41652

Laboratory: Ecology, Manchester

Sample No: 88 228138 Description: BW ITT RAYONIER

Begin Date: 88/05/23 :

		Sediment		VOA - PP Scan (GCMS)		Sediment		VOA - PP Scan (GCMS)		Sediment		
	Gen Inorg/Phys-Speci	Sediment Result	Units	VOA - PP Scan (GCMS) Result	Units	Continued ***	Sediment Result	VOA - PP Scan (GCMS) Result	Units	Continued ***	Sediment Result	
Cyanide	Sedmt	0.06U	mg/kg-dr	1,1-Dichloroethane	12U	ug/kg	2,2-Dichloropropane	12U	ug/kg	2,2-Hexanone	23U	ug/kg
Metals - PP	Sediment Result	Units		1,1-Dichloroethene	12U	ug/kg	Ethane, 1,1,1,2-Tetrac+	12U	ug/kg	Ethane, 1,1,1,2-Tetrac+	12U	ug/kg
				Trichlorofluoromethane	12U	ug/kg	cis-1,3-Dichloropropene	12U	ug/kg	cis-1,3-Dichloropropene	12U	ug/kg
				Methane, Dichlorodiflu+	23U	ug/kg	trans-1,3-Dichloroprop+	12U	ug/kg	trans-1,3-Dichloroprop+	12U	ug/kg
				1,2-Dichloropropane	12U	ug/kg	Surrog: D4-1-Chloropro+	96%	% Recov	Surrog: D4-1-Chloropro+	96%	% Recov
Arsenic	As-Sedmt	4.1 *	mg/kg-dr	2-Butanone	7U	ug/kg	Surrog: 1,4-Bromofluor+	81%	% Recov	Surrog: 1,4-Bromofluor+	81%	% Recov
Lead	Pb-Sedmt	3.1 *	mg/kg-dr	1,1,2-Trichloroethane	12U	ug/kg	Surrog: D8-Toluene	104%	% Recov	Surrog: D8-Toluene	104%	% Recov
Silver	Ag-Sedmt	0.02U	mg/kg-dr	Trichloroethene	12U	ug/kg						
Antimony	Sb-Sedmt	0.1U	mg/kg-dr	1,1,2,2-Tetrachloroeth+	12U	ug/kg						
Selenium	Se-Sedmt	0.4 *	mg/kg-dr	1,2,3-Trichlorobenzene	12U	ug/kg						
Thallium	Tl-Sedmt	0.1U	mg/kg-dr	Hexachlorobutadiene	12U	ug/kg						
Mercury	Hg-Sedmt	0.029 *	mg/kg-wt	Naphthalene	12U	ug/kg						
				Total Xylenes	12U	ug/kg						
				2-Chlorotoluene	12U	ug/kg	Benzo(a)Pyrene	130U	ug/kg	2,4-Dinitrophenol	650U	ug/kg
				1,2-Dichlorobenzene	12U	ug/kg	Dibenzo(a,h)anthracene	130U	ug/kg	Dibenzo(a,h)anthracene	130U	ug/kg
				1,2,4-Trimethylbenzene	12U	ug/kg	4-Chloro-3-Methylphenol	130U	ug/kg	4-Chloro-3-Methylphenol	130U	ug/kg
				DBCP	12U	ug/kg	Benzoic acid	650U	ug/kg	Benzoic acid	650U	ug/kg
				1,2,3-Trichloropropane	12U	ug/kg	Hexachloroethane	130U	ug/kg	Hexachloroethane	130U	ug/kg
				Tert-Butylbenzene	12U	ug/kg	Isophorone	270U	ug/kg	Isophorone	270U	ug/kg
Beryllium	Be-Sedmt	1.1 *	mg/kg-dr	Isopropylbenzene (Cume+)	12U	ug/kg	Acenaphthene	130U	ug/kg	Acenaphthene	130U	ug/kg
Cadmium	Cd-Sedmt	0.5U	mg/kg-dr	p-Isopropyltoluene	12U	ug/kg	Diethylphthalate	130BU	ug/kg	Diethylphthalate	130BU	ug/kg
Chromium	Cr-Sedmt	3.5 *	mg/kg-dr	Ethylbenzene	12U	ug/kg	Di-n-Butylphthalate	26BJ*	ug/kg	Di-n-Butylphthalate	26BJ*	ug/kg
Copper	Cu-Sedmt	56.1 *	mg/kg-dr	Styrene	12U	ug/kg	Phenanthrene	120J*	ug/kg	Phenanthrene	120J*	ug/kg
Lead	Pb-Sedmt	5.4 *	mg/kg-dr	Benzene, Propyl-	12U	ug/kg	Butylbenzylphthalate	130BU	ug/kg	Butylbenzylphthalate	130BU	ug/kg
Nickel	Ni-Sedmt	57.7 *	mg/kg-dr	Butylbenzene	12U	ug/kg	N-Nitrosodiphenylamine	130U	ug/kg	N-Nitrosodiphenylamine	130U	ug/kg
Zinc	Zn-Sedmt	80.8 *	mg/kg-dr	4-Chlorotoluene	12U	ug/kg	Carbazole	130U	ug/kg	Carbazole	130U	ug/kg
Tin	Sn-Sedmt	109. *	mg/kg-dr	1,4-Dichlorobenzene	12U	ug/kg	Hexachlorobutadiene	130U	ug/kg	Hexachlorobutadiene	130U	ug/kg
				1,2-Dibromoethane (EDB)	12U	ug/kg	Pentachlorophenol	650U	ug/kg	Pentachlorophenol	650U	ug/kg
				1,2-Dichloroethane	12U	ug/kg	2,4,6-Trichlorophenol	130U	ug/kg	2,4,6-Trichlorophenol	130U	ug/kg
				Vinyl Acetate	23U	ug/kg	2-Nitroaniline	650U	ug/kg	2-Nitroaniline	650U	ug/kg
				4-Methyl-2-Pentanone	23U	ug/kg	2-Nitrophenol	130U	ug/kg	2-Nitrophenol	130U	ug/kg
Carbon Tetrachloride	Sediment Result	Units		1,3,5-Trimethylbenzene	12U	ug/kg	1-Naphthalene, 1-Methyl-	130U	ug/kg	1-Naphthalene, 1-Methyl-	130U	ug/kg
Acetone				Bromobenzene	12U	ug/kg	Naphthalene	12U	ug/kg	Naphthalene	12U	ug/kg
Chloroform				Tetrachloroethene	12U	ug/kg	2-Methylnaphthalene	12U	ug/kg	2-Methylnaphthalene	12U	ug/kg
Benzene				Sec-Butylbenzene	12U	ug/kg	2-Chloronaphthalene	12U	ug/kg	2-Chloronaphthalene	12U	ug/kg
				Chlorobenzene	12U	ug/kg	3,3'-Dichlorobenzidine	130U	ug/kg	3,3'-Dichlorobenzidine	130U	ug/kg
				1,2,4-Trichlorobenzene	23U	ug/kg	2-Methylphenol	130U	ug/kg	2-Methylphenol	130U	ug/kg
Bromomethane				Dibromochloromethane	23U	ug/kg	1,2-Dichlorobenzene	130U	ug/kg	1,2-Dichlorobenzene	130U	ug/kg
Chloromethane				Tetrachloroethene	12U	ug/kg	o-Chlorophenol	130U	ug/kg	o-Chlorophenol	130U	ug/kg
Dibromomethane				Sec-Butylbenzene	23U	ug/kg	2,4,5-Trichlorophenol	650U	ug/kg	2,4,5-Trichlorophenol	650U	ug/kg
Chloroethane				Chlorobenzene	12U	ug/kg						
Vinyl Chloride				1,2,4-Trichlorobenzene	23U	ug/kg						
Methylene Chloride				Cis-1,2-Dichloroethene	8U	ug/kg						
Carbon Disulfide				trans-1,2-Dichloroethene	12U	ug/kg						
Bromoform				1,3-Dichlorobenzene	12U	ug/kg						
Bromodichloromethane				1,1-Dichloropropane	12U	ug/kg						

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Project: DOE-541F GRAYS HARBOR SALMON SURVEY

Laboratory: Ecology, Manchester

Sample No: 88 2228138

Description: BW ITT RAYONIER

Begin Date: 88/05/23 :

B/N/Acid Scan		Sediment		Resin Acids Guaiacol		Sediment Result		Pest/PCB - PP Scan		Sediment Result		Units	
	*** Continued	Result	Units	Result	Units	Result	Units	Result	Units	Result	Units	Result	Units
Nitrobenzene		130U	ug/kg	Linoleic acid	1200J*	ug/kg	4,4'-DDT		1U	ug/kg			
3-Nitroaniline		650U	ug/kg	Guaiacol (2-methoxyphen+)	130U	ug/kg	Chlordane		1U	ug/kg			
4-Nitroaniline		650U	ug/kg	4-Allylguaiacol (eugen+)	130U	ug/kg	gamma-BHC (Lindane)		1U	ug/kg			
4-Nitrophenol		650U	ug/kg	Oleic acid	3500J*	ug/kg	Diethyltin		1U	ug/kg			
Benzyl Alcohol		130U	ug/kg	Sandaracopimaric acid	130U	ug/kg	Endrin		1U	ug/kg			
4-Bromophenyl-phenylet+		130U	ug/kg	Abietic acid	130U	ug/kg	4,4'-DDD		1U	ug/kg			
2,4-Dimethylphenol		130U	ug/kg	Tetrachloroguaicol	130U	ug/kg	4,4'-DDE		1U	ug/kg			
4-Methylphenol	*	170	ug/kg	4,5,6-Trichloroguaicol	130U	ug/kg	Heptachlor		1U	ug/kg			
BIS(2-ETHYLHEXYL) PHTH+		610B*	ug/kg	9,10-Dichlorosteric ac+	130U	ug/kg	Aldrin		1U	ug/kg			
1,4-Dichlorobenzene		130U	ug/kg	Dichlorodihydroabietic+	130U	ug/kg	alpha-BHC		1U	ug/kg			
1-Chloroaniline		130U	ug/kg	Dehydroabietic acid	3400JB*	ug/kg	beta-BHC		1U	ug/kg			
Phenol		130U	ug/kg	4,5-Dichloroguaicol	130U	ug/kg	delta-BHC		1U	ug/kg			
bis(2-Chloroethyl) Ether		130U	ug/kg	Trichlorosyringol	130U	ug/kg	alpha-Endosulfan		1U	ug/kg			
bis(2-Chloroethoxy) Met+		130U	ug/kg	Isopimaric acid	130U	ug/kg	Heptachlor epoxide		1U	ug/kg			
BIS(2-ETHYLHEXYL) PHTH+		610B*	ug/kg	4-Chloroguaicol	130U	ug/kg	Endosulfan sulfate		1U	ug/kg			
Di-n-Octyl Phthalate	*	510B*	ug/kg	Surrog: Pyrene D10	35%	% Recov	Endrin aldehyde		1U	ug/kg			
Hexachlorobenzene		130U	ug/kg	Surrog: 2-Fluoro, 1-met+	65%	% Recov	Toxaphene		30U	ug/kg			
Anthracene		130U	ug/kg	Surrog: 2-Fluorobiphen+	25%	% Recov	PCB - 1260		10U	ug/kg			
1,2,4-Trichlorobenzene		130U	ug/kg	Surrog: 2-Fluorophenol	17%	% Recov	PCB - 1254		10U	ug/kg			
2,4-Dichlorophenol		130U	ug/kg	Surrog: Heptaadecanoic +	110	% Recov	PCB - 1221		10U	ug/kg			
2,4-Dinitrotoluene		130U	ug/kg	Surrog: D14-Terphenyl 1	34%	% Recov	PCB - 1232		10U	ug/kg			
Pyrene		160*	ug/kg	Surrog: 2-Naphthoic ac+	37	% Recov	PCB - 1248		10U	ug/kg			
Dimethylphthalate		130U	ug/kg	Surrog: D5-Nitrobenzene	19%	% Recov	PCB - 1016		10U	ug/kg			
Dibenzofuran		211J*	ug/kg	Surrog: D5-Phenol	80%	% Recov	beta-Endosulfan		1U	ug/kg			
Benzo(ghi)perylene		130U	ug/kg	Surrog: o-Methylpodoca+	55	% Recov	PCB - 1242		10U	ug/kg			
Indeno(1,2,3-cd)pyrene		130U	ug/kg	+ Misc GC Specified			Intstd: Hexabromobenz+						
Benzo(b)fluoranthene		110J*	ug/kg										
Fluoranthene		130U	ug/kg										
Benzo(k)fluoranthene		130U	ug/kg										
Acenaphthylene		130U	ug/kg										
Chrysene		540*	ug/kg										
Retene		650U	ug/kg	Aldicarb	300U	ug/kg							
4,6-Dinitro-2-methylph+		130U	ug/kg	Simazine	150U	ug/kg							
1,3-Dichlorobenzene		130U	ug/kg	Diuron	60U	ug/kg							
2,6-Dinitrotoluene		130U	ug/kg	Atrazine	60U	ug/kg							
N-Nitroso-di-n-Propyl-		130U	ug/kg	Butylate	60U	ug/kg							
4-Chlorophenyl-phenyle+		130U	ug/kg	Metrribuzin	60U	ug/kg							
bis(2-Chloroisopropyl)+		130U	ug/kg	Fenamiphos	30U	ug/kg							
Surrog: D10-Pyrene		130U	ug/kg	Pronamide	150U	ug/kg							
Surrog: 2-Fluorobiphen+		120%	% Recov	Hexazinone	30U	ug/kg							
Surrog: 2-Fluorophenol		44%	% Recov										
Surrog: D14-Terphenyl		40%	% Recov										
Surrog: D5-Nitrobenzene		133%	% Recov										
Surrog: D5-Phenol		30%	% Recov										
Surrog: D5-Phenol		44%	% Recov										

(Sample Complete)

Project: DOE-541F GRAYS HARBOR SALMON SURVEY

Laboratory: Ecology, Manchester

Sample No: 88 228139

Description: MOON IS

Begin Date: 88/05/24

Cyanide	Sedmt	Sediment			VOA - PP Scan (GCMS)			Sediment			VOA - PP Scan (GCMS)			Sediment				
		Result	Units	Units	***	Continued	***	Result	Units	Units	Result	Units	Result	Units	Result	Units		
Cyanide	0 .04U	mg/kg-dr	+1,1-Dichloroethane	8U	ug/kg	2,2-Dichloropropane	8U	ug/kg	2-Hexanone	17U	ug/kg	2,4-Dinitrophenol	92U	ug/kg	2,4-Dinitrophenol	450U	ug/kg	
Metals - PP	Sedmt	Sediment	Result	Units	Units	1,1-Dichloroethene	8U	ug/kg	Ethane, 1,1,1,2-Tetrachloroethane	8U	ug/kg	Ethane, 1,1,1,2-Tetrachloroethene	17U	ug/kg	Ethane, 1,1,1,2-Tetrachloroethene	450U	ug/kg	
Arsenic	As-Sedmt	3.5 *	mg/kg-dr	+Trichlorofluoromethane	8U	ug/kg	Methane, Dichlorodifluoromethane	17U	ug/kg	cis-1,3-Dichloropropene	8U	ug/kg	cis-1,3-Dichloropropene	92U	ug/kg	cis-1,3-Dichloropropene	450U	ug/kg
Lead	Pb-Sedmt	2.4 *	mg/kg-dr	+1,2-Dichloropropane	8U	ug/kg	trans-1,3-Dichloropropene	8U	ug/kg	Surrog: D4-1,2-Dichloropropene	99%	% Recov	Surrog: D4-1,2-Dichloropropene	99%	% Recov	Surrog: D4-1,2-Dichloropropene	450U	ug/kg
Silver	Ag-Sedmt	0.02U	mg/kg-dr	+2-Butanone	4U	ug/kg	Surrog: 1,4-Bromofluorobutane	8U	ug/kg	Surrog: 1,4-Bromofluorobutane	81%	% Recov	Surrog: 1,4-Bromofluorobutane	81%	% Recov	Surrog: 1,4-Bromofluorobutane	450U	ug/kg
Antimony	Sb-Sedmt	0.1U	mg/kg-dr	+1,1,2-Trichloroethene	8U	ug/kg	Surrog: D8-Toluene	8U	ug/kg	Surrog: D8-Toluene	105%	% Recov	Surrog: D8-Toluene	105%	% Recov	Surrog: D8-Toluene	450U	ug/kg
Selenium	Se-Sedmt	0.1 *	mg/kg-dr	+1,1,2,2-Tetrachloroethane	8U	ug/kg	+B/N Acid Scan	8U	ug/kg	+B/N Acid Scan	8U	ug/kg	+B/N Acid Scan	8U	ug/kg	+B/N Acid Scan	8U	ug/kg
Thallium	Tl-Sedmt	0.1U	mg/kg-dr	+1,2,3-Trichlorobenzene	8U	ug/kg	Benzo(a)Pyrene	92U	ug/kg	Benzo(a)Pyrene	92U	ug/kg	Benzo(a)Pyrene	92U	ug/kg	Benzo(a)Pyrene	92U	ug/kg
Mercury	Hg-Sedmt	0.023 *	mg/kg-wt	+Hexachlorobutadiene	8U	ug/kg	2,4-Dinitrophenol	450U	ug/kg	2,4-Dinitrophenol	450U	ug/kg	2,4-Dinitrophenol	450U	ug/kg	2,4-Dinitrophenol	450U	ug/kg
				Naphthalene	8U	ug/kg	Benzo(a,h)anthracene	92U	ug/kg	Benzo(a,h)anthracene	92U	ug/kg	Benzo(a,h)anthracene	92U	ug/kg	Benzo(a,h)anthracene	92U	ug/kg
				Total Xylenes	8U	ug/kg	4-Chlorophenol	92U	ug/kg	4-Chlorophenol	92U	ug/kg	4-Chlorophenol	92U	ug/kg	4-Chlorophenol	92U	ug/kg
				2-Chlorotoluene	8U	ug/kg	4-Chlorotoluene	92U	ug/kg	4-Chlorotoluene	92U	ug/kg	4-Chlorotoluene	92U	ug/kg	4-Chlorotoluene	92U	ug/kg
				1,2-Dichlorobenzene	8U	ug/kg	4-Chlorobiphenyl	92U	ug/kg	4-Chlorobiphenyl	92U	ug/kg	4-Chlorobiphenyl	92U	ug/kg	4-Chlorobiphenyl	92U	ug/kg
				DBCP	8U	ug/kg	4-Chlorophenol	92U	ug/kg	4-Chlorophenol	92U	ug/kg	4-Chlorophenol	92U	ug/kg	4-Chlorophenol	92U	ug/kg
Beryllium	Be-Sedmt	0.7 *	mg/kg-dr	+1,2,3-Trichloropropane	8U	ug/kg	4-Chlorophenol	92U	ug/kg	4-Chlorophenol	92U	ug/kg	4-Chlorophenol	92U	ug/kg	4-Chlorophenol	92U	ug/kg
Cadmium	Cd-Sedmt	0.9 *	mg/kg-dr	+Tert-Butylbenzene	8U	ug/kg	4-Chlorophenol	92U	ug/kg	4-Chlorophenol	92U	ug/kg	4-Chlorophenol	92U	ug/kg	4-Chlorophenol	92U	ug/kg
Chromium	Cr-Sedmt	25.4 *	mg/kg-dr	+Isopropylbenzene (Cumene)	8U	ug/kg	4-Chlorophenol	92U	ug/kg	4-Chlorophenol	92U	ug/kg	4-Chlorophenol	92U	ug/kg	4-Chlorophenol	92U	ug/kg
Copper	Cu-Sedmt	30.9 *	mg/kg-dr	+P-Isopropyltoluene	8U	ug/kg	4-Chlorophenol	92U	ug/kg	4-Chlorophenol	92U	ug/kg	4-Chlorophenol	92U	ug/kg	4-Chlorophenol	92U	ug/kg
Lead	Pb-Sedmt	3.5 *	mg/kg-dr	+Ethylbenzene	8U	ug/kg	4-Chlorophenol	92U	ug/kg	4-Chlorophenol	92U	ug/kg	4-Chlorophenol	92U	ug/kg	4-Chlorophenol	92U	ug/kg
Nickel	Ni-Sedmt	45.7 *	mg/kg-dr	+Styrene	8U	ug/kg	4-Chlorophenol	92U	ug/kg	4-Chlorophenol	92U	ug/kg	4-Chlorophenol	92U	ug/kg	4-Chlorophenol	92U	ug/kg
Zinc	Zn-Sedmt	58.6 *	mg/kg-dr	+Benzene, Propyl-	8U	ug/kg	4-Chlorophenol	92U	ug/kg	4-Chlorophenol	92U	ug/kg	4-Chlorophenol	92U	ug/kg	4-Chlorophenol	92U	ug/kg
Tin	Tn-Sedmt	82.5 *	mg/kg-dr	+Butylbenzene	8U	ug/kg	4-Chlorophenol	92U	ug/kg	4-Chlorophenol	92U	ug/kg	4-Chlorophenol	92U	ug/kg	4-Chlorophenol	92U	ug/kg
				4-Chlorotoluene	8U	ug/kg	4-Nitrosodiphenylamine	92U	ug/kg	4-Nitrosodiphenylamine	92U	ug/kg	4-Nitrosodiphenylamine	92U	ug/kg	4-Nitrosodiphenylamine	92U	ug/kg
				1,4-Dichlorobenzene	8U	ug/kg	Carbazole	92U	ug/kg	Carbazole	92U	ug/kg	Carbazole	92U	ug/kg	Carbazole	92U	ug/kg
				1,2-Dibromoethane (EDB)	17U	ug/kg	Fluorene	92U	ug/kg	Fluorene	92U	ug/kg	Fluorene	92U	ug/kg	Fluorene	92U	ug/kg
				1,2-Dichloroethane	8U	ug/kg	Hexachlorobutadiene	92U	ug/kg	Hexachlorobutadiene	92U	ug/kg	Hexachlorobutadiene	92U	ug/kg	Hexachlorobutadiene	92U	ug/kg
Carbon Tetrachloride	8U	ug/kg	Vinyl Acetate	17U	ug/kg	Pentachlorophenol	450U	ug/kg	Pentachlorophenol	450U	ug/kg	Pentachlorophenol	450U	ug/kg	Pentachlorophenol	450U	ug/kg	
Acetone	22U	ug/kg	4-Methyl-1-2-Pentanone	8U	ug/kg	2,4,6-Trichlorophenol	92U	ug/kg	2,4,6-Trichlorophenol	92U	ug/kg	2,4,6-Trichlorophenol	92U	ug/kg	2,4,6-Trichlorophenol	92U	ug/kg	
Chloroform	8U	ug/kg	1,3,5-Trimethylbenzene	8U	ug/kg	0,5-U	ug/kg	0,5-U	ug/kg	0,5-U	ug/kg	0,5-U	ug/kg	0,5-U	ug/kg	0,5-U	ug/kg	
Benzene	8U	ug/kg	Bromobenzene	8U	ug/kg	2-Nitroaniline	450U	ug/kg	2-Nitroaniline	450U	ug/kg	2-Nitroaniline	450U	ug/kg	2-Nitroaniline	450U	ug/kg	
1,1,1-Trichloroethane	8U	ug/kg	Toluene	8U	ug/kg	2-Nitrophenol	92U	ug/kg	2-Nitrophenol	92U	ug/kg	2-Nitrophenol	92U	ug/kg	2-Nitrophenol	92U	ug/kg	
Bromomethane	17U	ug/kg	Chlorobenzene	8U	ug/kg	Naphthalene, 1-Methyl-	92U	ug/kg	Naphthalene, 1-Methyl-	20BJ*	ug/kg	Naphthalene, 1-Methyl-	20BJ*	ug/kg	Naphthalene, 1-Methyl-	20BJ*	ug/kg	
Chloroethane	8U	ug/kg	1,2,4-Trichlorobenzene	8U	ug/kg	Naphthalene	92U	ug/kg	Naphthalene	92U	ug/kg	Naphthalene	92U	ug/kg	Naphthalene	92U	ug/kg	
Dibromomethane	8U	ug/kg	Dibromochloromethane	8U	ug/kg	2-Methylnaphthalene	92U	ug/kg	2-Methylnaphthalene	92U	ug/kg	2-Methylnaphthalene	92U	ug/kg	2-Methylnaphthalene	92U	ug/kg	
Vinyl Chloride	17U	ug/kg	Tetrachloroethene	8U	ug/kg	3-Chloronaphthalene	92U	ug/kg	3-Chloronaphthalene	92U	ug/kg	3-Chloronaphthalene	92U	ug/kg	3-Chloronaphthalene	92U	ug/kg	
Methylene Chloride	7U	ug/kg	Sec-Butylbenzene	8U	ug/kg	3,3'-Dichlorobenzidine	92U	ug/kg	3,3'-Dichlorobenzidine	92U	ug/kg	3,3'-Dichlorobenzidine	92U	ug/kg	3,3'-Dichlorobenzidine	92U	ug/kg	
Carbon Disulfide	8U	ug/kg	1,3-Dichloroethene	8U	ug/kg	2-Methylphenol	92U	ug/kg	2-Methylphenol	92U	ug/kg	2-Methylphenol	92U	ug/kg	2-Methylphenol	92U	ug/kg	
Bromoform	8U	ug/kg	1,3-Dichlorobenzene	8U	ug/kg	1,2-Dichlorobenzene	92U	ug/kg	1,2-Dichlorobenzene	92U	ug/kg	1,2-Dichlorobenzene	92U	ug/kg	1,2-Dichlorobenzene	92U	ug/kg	
Bromodichloromethane	8U	ug/kg	1,1-Dichloropropane	8U	ug/kg	o-Chlorophenol	92U	ug/kg	o-Chlorophenol	92U	ug/kg	o-Chlorophenol	92U	ug/kg	o-Chlorophenol	92U	ug/kg	

(continued on next page)

Project: DOE-541F GRAYS HARBOR SALMON SURVEY

Laboratory: Ecology, Manchester

Sample No: 88 228139

Description: MOON IS

Begin Date: 88/05/24 :

B/N/Acid Scan	Scan	Sediment	Continued ***	Result	Units	Resin Acids	Guaiacol	Sediment Result	Units	Pest/PCB - PP Scan	Sediment Result	Units
Nitrobenzene		92U	ug/kg	Linoleic acid		390 *	ug/kg	4,4'-DDT		1U	ug/kg	
3-Nitroaniline	450U	ug/kg	Guaicol (2-methoxyphenet+ Guaiacol (eugen+		92U	ug/kg	Chlordane		1U	ug/kg		
4-Nitroaniline	450U	ug/kg	Oleic acid		990J *	ug/kg	gamma-BHC (Lindane)		1U	ug/kg		
4-Nitrophenol	450U	ug/kg	Sandaracopimaric acid		92U	ug/kg	Dieldrin		1U	ug/kg		
Benzyl Alcohol	92U	ug/kg	Abietic acid		92U	ug/kg	Endrin		1U	ug/kg		
4-Bromophenyl-phenylet+	92U	ug/kg	Tetrachloroguaicolo		92U	ug/kg	4,4'-DDD		1U	ug/kg		
2,4-Dimethylphenol	92U	ug/kg	4,5,6-Trichloroguaicolo		92U	ug/kg	4,4'-DDE		1U	ug/kg		
4-MethylPhenol	92U	ug/kg	9,10-Dichlorosteric ac+		92U	ug/kg	Heptachlor		1U	ug/kg		
1,4-Dichlorobenzene	92U	ug/kg	Dichlorodehydروابيكت+		92U	ug/kg	Aldrin		1U	ug/kg		
4-Chloroaniline	92U	ug/kg	Dehydroabietic acid		190JB *	ug/kg	alpha-BHC		1U	ug/kg		
Phenol	92BU	ug/kg	4,5-Dichloroguaicolo		92U	ug/kg	beta-BHC		1U	ug/kg		
bis(2-Chloroethyl) Ether	92U	ug/kg	Trichlorosyringol		92U	ug/kg	delta-BHC		1U	ug/kg		
bis(2-Chloroethoxy) Met+	92U	ug/kg	Isopimaric acid		61J *	ug/kg	alpha-Endosulfan		1U	ug/kg		
BIS(2-ETHYLHEXYL) PHTH+	69BJ *	ug/kg	4-Chloroguaicolo		92U	ug/kg	Heptachlor epoxide		1U	ug/kg		
Di-n-Octyl Phthalate	92BU	ug/kg	Surrog: Pyrene D10		57 %	% Recov	Endosulfan sulfate		1U	ug/kg		
Hexachlorobenzene	92U	ug/kg	Surrog: 2-Fluoro, 1-met+		48 %	% Recov	Endrin aldehyde		1U	ug/kg		
Anthracene	92U	ug/kg	Surrog: 2-Fluorobiphen+		47 %	% Recov	Toxaphene		30U	ug/kg		
1,2,4-Trichlorobenzene	92U	ug/kg	Surrog: 2-Fluorophenol		28 %	% Recov	alpha-Endosulfan		1U	ug/kg		
2,4-Dichlorophenol	92U	ug/kg	Surrog: Hepta-decanoic +		83 %	% Recov	Heptachlor		1U	ug/kg		
2,4-Dinitrotoluene	92U	ug/kg	Surrog: D14-Terphenoyle		46 %	% Recov	PCB - 1221		1U	ug/kg		
Pyrene	91J *	ug/kg	Surrog: 2-Naphthoic ac+		48 %	% Recov	PCB - 1232		1U	ug/kg		
DimethylPhthalate	92U	ug/kg	Surrog: D5-Nitrobenzene		35 %	% Recov	PCB - 1248		1U	ug/kg		
Dibenzofuran	92U	ug/kg	Surrog: D5-Phenol		102 %	% Recov	PCB - 1016		1U	ug/kg		
Benzo(ghi)perylene	92U	ug/kg	Surrog: o-Methylpodocat+		77	% Recov	beta-Endosulfan		10U	ug/kg		
Indeno(1,2,3-cd)Pyrene	92U	ug/kg					Intstd: Hexabromobenzene+		10U	ug/kg		
Benzo(b)fluoranthene	59J *	ug/kg							99 %	ug/kg		
Fluoranthene	92U	ug/kg	Misc GC Specified									
Benzo(k)fluoranthene	92U	ug/kg										
Acenaphthylene	92U	ug/kg										
Chrysene	92U	ug/kg										
Retene	240 *	ug/kg										
4,6-Dinitro-2-methylph+	450U	ug/kg										
1,3-Dichlorobenzene	92U	ug/kg										
2,6-Dinitrotoluene	92U	ug/kg										
N-Nitroso-di-n-Propyla+	92U	ug/kg										
4-Chlorophenyl-phenyle+	92U	ug/kg										
bis(2-Chloroisopropyl)+	92U	ug/kg										
Surrog: D10-Pyrene	118 %	% Recov										
Surrog: 2-Fluorobiphen+	65 %	% Recov										
Surrog: D4-Terphenyl	46 %	% Recov										
Surrog: D5-Nitrobenzene	40 %	% Recov										
Surrog: D5-Phenol	46 %	% Recov										

(Sample Complete)

Project: DOE-541F GRAYS HARBOR SALMON SURVEY

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Officer: DXR Account: 41652

Laboratory: Ecology, Manchester

Sample No: 88 228140 Description: STEARN BL.

Begin Date: 88/05/24 :

		Source: Sediment (General)			Source: Sediment (GCMS)			Sediment					
		VOA - PP Scan (GCMS)			VOA - PP Scan (GCMS)			Sediment					
		Result *** Continued			Result *** Continued			Result ***					
Cyanide	Sedmt	0.03U	mg/kg-dr					Result	Units	Result	Units		
Gen Inorg/Phys-Speci	Sediment												
Metals - PP	Sediment												
Metals - Sedmt	Sediment												
Arsenic	As-Sedmt	4.8	*	mg/kg-dr	1,1-Dichloroethane	6U	ug/kg	2,2-Dichloropropane	6U	ug/kg	1,1-Dichloroethene	6U	ug/kg
Pb-Sedmt	Pb-Sedmt	0.5U	mg/kg-dr	Trichlorofluoromethane	6U	ug/kg	2-Hexanone	6U	ug/kg	Ethane, 1,1,1,2-Tetra-	6U	ug/kg	
Silver	Ag-Sedmt	0.02U	mg/kg-dr	Methane, Dichlorodiflu+	11U	ug/kg	Ethane, 1,1,1,2-Tetra-	6U	ug/kg	cis-1,3-Dichloropropene	6U	ug/kg	
Antimony	Sb-Sedmt	0.1U	mg/kg-dr	1,2-Dichloropropane	6U	ug/kg	cis-1,3-Dichloropropene	6U	ug/kg	trans-1,3-Dichloroprop+	6U	ug/kg	
Selenium	Se-Sedmt	0.7	*	mg/kg-dr	2-Butanone	1U	ug/kg	Surrog: D4-1,2-Dichloro+	100%	% Recov	Surrog: D4-1,2-Dichloro+	100%	% Recov
Thallium	Tl-Sedmt	0.1U	mg/kg-dr	Trichloroethene	6U	ug/kg	Surrog: 1,4-Bromofluor+	88%	% Recov	Surrog: D8-Toluene	98%	% Recov	
Mercury	Hg-Sedmt	0.011	*	mg/kg-wt	Hexachlorobutadiene	6U	ug/kg	Surrog: D8-Toluene	98%	% Recov	Naphthalene	6U	ug/kg
		Total Xylenes			B/N/Acid Scan			Sediment			Sediment		
		Metals - ICP Scan			Result			Result			Result		
Beryllium	Be-Sedmt	0.7	*	mg/kg-dr	2-Chlorotoluene	6U	ug/kg	Benzo(a)Pyrene	71U	ug/kg	2,4-Dinitrophenol	340U	ug/kg
Cadmium	Cd-Sedmt	0.5U	mg/kg-dr	1,2-Dichlorobenzene	6U	ug/kg	Dibenzo(a,h)anthracene	71U	ug/kg	Dibenzo(a,h)anthracene	71U	ug/kg	
Chromium	Cr-Sedmt	16.3	*	mg/kg-dr	DBCP	6U	ug/kg	Benzo(a)anthracene	71U	ug/kg	4-Chloro-3-Methylphenol	71U	ug/kg
Copper	Cu-Sedmt	19.3	*	mg/kg-dr	1,2,3-Trichloropropane	6U	ug/kg	Benzoic acid	340U	ug/kg	Benzoic acid	340U	ug/kg
Lead	Pb-Sedmt	5U	mg/kg-dr	Tert-Butylbenzene	6U	ug/kg	Hexachloroethane	71U	ug/kg	Hexachloroethane	71U	ug/kg	
Nickel	Ni-Sedmt	47.7	*	mg/kg-dr	Isopropylbenzene (Cumene)	6U	ug/kg	Isophorone	140U	ug/kg	Isophorone	71U	ug/kg
Zinc	Zn-Sedmt	51.6	*	mg/kg-dr	p-Isopropyltoluene	6U	ug/kg	Acenaphthene	71U	ug/kg	Acenaphthene	71U	ug/kg
Tin	Sn-Sedmt	83.1	*	mg/kg-dr	Ethylbenzene	6U	ug/kg	Diethylphthalate	71BU	ug/kg	Diethylphthalate	71BU	ug/kg
		Metals - PP Scan (GCMS)			Sediment			B-Nitrosodiphenylamine			B-Nitrosodiphenylamine		
Carbon Tetrachloride	Sediment				Result	Units		Result	Units		Result	Units	
Acetone													
Chloroform													
Benzene													
1,1,1-Trichloroethane													
Bromomethane													
Chloromethane													
Dibromomethane													
Chloroethane													
Vinyl Chloride													
Methylene Chloride													
Carbox Disulfide													
Bromoform													
Bromodichloromethane													

Project: DOE-541F GRAYS HARBOR SALMON SURVEY

Laboratory: Ecology, Manchester

Description: STEARN BL.

Begin Date: 88/05/24 :

Source: Sediment (General)

Officer: DXR
Account: 41652

Sample No: 88 228140

B/N/Acid Scan	*** Continued ***	Sediment		Resin Acids Guaiacol		Sediment		Pest/PCB - PP Scan		Sediment	
		Result	Units	Result	Units	Result	Units	Result	Units	Result	Units
Nitrobenzene		71U	ug/kg	Linoleic acid	8J*	ug/kg		4,4'-DDT		1U	ug/kg
3-Nitroaniline		340U	ug/kg	Guaiacol (2-methoxyphen+ 4-Allylguaiacol (eugen+ Oleic acid	71U	ug/kg		Chlordane		1U	ug/kg
4-Nitroaniline		340U	ug/kg	Sandaracopimaric acid	83J*	ug/kg		gamma-BHC (Lindane)		1U	ug/kg
4-Nitrophenol		340U	ug/kg	Abietic acid	71U	ug/kg		Diehrdin		1U	ug/kg
Benzyl Alcohol		71U	ug/kg	Tetrachloroguaicolic acid	71U	ug/kg		4,4'-DDD		1U	ug/kg
4-Bromophenyl-Phenylet+		71U	ug/kg	4,5,6-Trichloroguaicolic acid	71U	ug/kg		4,4'-DDE		1U	ug/kg
2,4-Dimethylphenol		71U	ug/kg	9,10-Dichlorosteric ac+	71U	ug/kg		Heptachlor		1U	ug/kg
4-Methylphenol		71U	ug/kg	Dichlorodenedroabietic+	16BJ*	ug/kg		Aldrin		1U	ug/kg
1,4-Dichlorobenzene		71U	ug/kg	Dehydroabietic acid	16BJ*	ug/kg		alpha-BHC		1U	ug/kg
4-Chloroaniline		71BU	ug/kg	4,5-Dichloroguaicolic acid	71U	ug/kg		delta-BHC		1U	ug/kg
Phenol		71U	ug/kg	Trichlorosyringol	71U	ug/kg		alpha-Endosulfan		1U	ug/kg
bis(2-Chloroethyl) Ether		71U	ug/kg	Isopimaric acid	71U	ug/kg		Heptachlor epoxide		1U	ug/kg
bis(2-Chloroethyl) Met+		95B*	ug/kg	4-Chloroguaicolic acid	71U	ug/kg		Endosulfan sulfate		1U	ug/kg
BIS(2-ETHYLHEXYL) PHTH+		71BU	ug/kg	Surrog: Pyrene D10	42%	% Recov		Endrin aldehyde		1U	ug/kg
Di-n-Octyl Phthalate		71U	ug/kg	Surrog: 2-Fluorobiphen+	203%	% Recov		Toxaphene		30U	ug/kg
Hexachlorobenzene		71U	ug/kg	Surrog: 2-Fluorophenol	35%	% Recov		PCB - 1260		10U	ug/kg
Anthracene		71U	ug/kg	Surrog: Heptadecanoic +	69%	% Recov		PCB - 1254		10U	ug/kg
1,2,4-Trichlorobenzene		71U	ug/kg	Surrog: D14-Terphenyl	42%	% Recov		PCB - 1221		10U	ug/kg
2,4-Dichlorophenol		71U	ug/kg	Surrog: 2-Naphthoic ac+	61%	% Recov		PCB - 1232		10U	ug/kg
2,4-Dinitrotoluene		71U	ug/kg	Surrog: D5-Nitrobenzene	40%	% Recov		PCB - 1248		10U	ug/kg
Pyrene		71U	ug/kg	Surrog: D5-Pheno1	40%	% Recov		PCB - 1016		10U	ug/kg
Dimethyl-phthalate		71U	ug/kg	Surrog: o-Methylpodoc+	73%	% Recov		beta-Endosulfan		1U	ug/kg
Dimethylbenzofuran		71U	ug/kg					PCB - 1242		10U	ug/kg
Dibenzo(g,h)i Perylene		71U	ug/kg					Int Std: Hexabromobenzen		88%	% Recov
Indeno(1,2,3-cd)pyrene		71U	ug/kg	Misc GC Specified							
Benzo(b)fluoranthene		71U	ug/kg								
Fluoranthene		71U	ug/kg								
Benzo(k)fluoranthene		71U	ug/kg								
Acenaphthylene		71U	ug/kg								
Chrysene		71U	ug/kg								
Retene		71U	ug/kg								
4,6-Dinitro-2-methylph+		340U	ug/kg	Aldicarb	160U	ug/kg					
1,3-Dichlorobenzene		71U	ug/kg	Simazine	80U	ug/kg					
2,6-Dinitrotoluene		71U	ug/kg	Diuron	80U	ug/kg					
N-Nitroso-di-n-Propyla+		71U	ug/kg	Atrazine	32U	ug/kg					
4-Chlorophenyl-Phenyle+		71U	ug/kg	Butylate	32U	ug/kg					
bis(2-Chloroisopropyl)+		71U	ug/kg	Metribuzin	32U	ug/kg					
Surrog: D10-Pyrene		102%	% Recov	Fenamiphos	16U	ug/kg					
Surrog: 2-Fluorobiphen+		49%	% Recov	Pronamide	80U	ug/kg					
Surrog: D14-Terphenyl		56%	% Recov	Hexazinone	16U	ug/kg					
Surrog: D5-Nitrobenzene		112%	% Recov								
Surrog: D5-Phenol		46%	% Recov								
		51%	% Recov								

(sample complete)

Project: DOE-541F GRAYS HARBOR SALMON SURVEY

Officer: DXR Account: 41652

Laboratory: Ecology, Manchester

Sample No: 88 228141 Description: HUMPTULP

Begin Date: 88/05/24 :

Source: Sediment (General)

		Sediment		Metals - ICP Scan		Sediment		VOA - PP Scan (GCMS)		Sediment	
		Result	Units	Matrix	Spike #2	Result	Units	Result	Units	Result	Units
Cyanide	Sedmt	0.03U	mg/kg-dr	Beryllium	Be-Sedmt	9.8	% Recov	Tert-Butylbenzene	6U	ug/kg	
				Cadmium	Cd-Sedmt	9.5	% Recov	Isopropylbenzene (Cumene)	6U	ug/kg	
				Chromium	Cr-Sedmt	9.6	% Recov	P-Isopropyltoluene	6U	ug/kg	
				Copper	Cu-Sedmt	9.8	% Recov	Ethylbenzene	6U	ug/kg	
				Lead	Pb-Sedmt	9.3	% Recov	Styrene	6U	ug/kg	
				Nickel	Ni-Sedmt	9.6	% Recov	Benzyne, Propyl-	6U	ug/kg	
Arsenic	As-Sedmt	3.8 *	mg/kg-dr	Zinc	Zn-Sedmt	9.9	% Recov	Butylbenzene	6U	ug/kg	
Lead	Pb-Sedmt	0.5U	mg/kg-dr	Tin	Sn-Sedmt	6.3	% Recov	4-Chlorotoluene	6U	ug/kg	
Silver	Ag-Sedmt	0.02U	mg/kg-dr	+ VOA - PP Scan (GCMS)		+ 1,4-Dichlorobenzene		1,2-Dibromoethane (EDB)	12U	ug/kg	
Antimony	Sb-Sedmt	0.1U	mg/kg-dr			+ 1,4-Dichloroethane		Vinyl Acetate	12U	ug/kg	
Selenium	Se-Sedmt	0.8 *	mg/kg-dr			+ 1,2-Dichloropropane		4-Methyl-2-Pentanone	12U	ug/kg	
Thallium	Tl-Sedmt	0.1U	mg/kg-dr			+ 1,3,5-Trimethylbenzene		1,1,2-Tribromopropane	6U	ug/kg	
Mercury	Hg-Sedmt	0.014 *	mg/kg-wt	Carbon Tetrachloride		+ 1,1,1,2-Tetrachloroethane		Bromobenzene	6U	ug/kg	
				Acetone		+ 1,1,1,2-Tetrachloroethane		Toluene	6U	ug/kg	
				Chloroform		+ 1,2,4-Trichlorobenzene		Chlorobenzene	6U	ug/kg	
				Benzene		+ 1,2,4-Trichloroethane		Dibromochloromethane	6U	ug/kg	
				+ 1,1,1,2-Tetrachloroethane		+ Sec-Butylbenzene		Tetrachloroethene	6U	ug/kg	
Beryllium	Be-Sedmt	0.8 *	mg/kg-dr	Bromomethane		+ 1,3-Dichloropropane		1,3-Dichloroethene	6U	ug/kg	
Cadmium	Cd-Sedmt	0.5U	mg/kg-dr	Chloromethane		+ Cis-1,2-Dichloroethene		1,4-Dichloroethene	6U	ug/kg	
Chromium	Cr-Sedmt	20.1 *	mg/kg-dr	Dibromomethane		+ trans-1,2-Dichloroethene		1,3-Dichlorobenzene	6U	ug/kg	
Copper	Cu-Sedmt	30.6 *	mg/kg-dr	Chloroethane		+ 1,3-Dichlorobenzene		1,4-Bromofluoride	6U	ug/kg	
Lead	Pb-Sedmt	5U	mg/kg-dr	Vinyl Chloride		+ 1,4-Bromofluoride		Carbon Disulfide	6U	ug/kg	
Nickel	Ni-Sedmt	56.3 *	mg/kg-dr	Methylene Chloride		+ 1,4-Bromofluoride		Bromodichloromethane	6U	ug/kg	
Zinc	Zn-Sedmt	60.3 *	mg/kg-dr	Carbon Disulfide		+ 1,1-Dichloroethane		1,1-Dichloroethane	6U	ug/kg	
Tin	Sn-Sedmt	99.1 *	mg/kg-dr	Bromoform		+ 1,1-Dichloroethane		2,2-Dichloropropane	6U	ug/kg	
				+ 1,1,1,2-Tetrachloroethane		+ 1,1,1,2-Tetrachloroethane		2-Hexanone	6U	ug/kg	
				Trichlorofluoromethane		+ 1,1,1,2-Tetrachloroethane		Ethane, 1,1,1,2-Tetrachloroethane	6U	ug/kg	
				Methane, Dichlororofluoromethane		+ cis-1,3-Dichloropropene		cis-1,3-Dichloropropene	6U	ug/kg	
Beryllium	Be-Sedmt	9.8	% Recov	+ 1,2-Dichloropropane		+ trans-1,3-Dichloropropene		Surrog: D4-1,2-Dichloroethene	99%	% Recov	
Cadmium	Cd-Sedmt	9.5	% Recov	2-Butanone		+ Surrog: D4-1,2-Dichloroethene		Surrog: 1,4-Bromofluoride	86%	% Recov	
Chromium	Cr-Sedmt	9.6	% Recov	1,1,2-Trichloroethane		+ Surrog: D8-Toluene		Surrog: D8-Toluene	98%	% Recov	
Copper	Cu-Sedmt	9.8	% Recov	Trichloroethene		+ Total Xylenes					
Lead	Pb-Sedmt	9.3	% Recov	1,1,2-Tetrachloroethene		+ B/N/Acid Scan		Benz(a)Pyrene	75U	ug/kg	
Nickel	Ni-Sedmt	9.6	% Recov	1,2,3-Trichlorobutadiene		+ 2,4-Dinitrophenol		2,4-Dinitrophenol	360U	ug/kg	
Zinc	Zn-Sedmt	9.9	% Recov	Naphthalene		+ Dibenzo(a,h)anthracene		Dibenzo(a,h)anthracene	75U	ug/kg	
Tin	Tin	6.3	% Recov			+ Benzo(a)anthracene		Benzo(a)anthracene	75U	ug/kg	
						+ 4-Chloro-3-Methylphenol		4-Chloro-3-Methylphenol	75U	ug/kg	

(Continued on next page)

Project: DOE-541F GRAYS HARBOR SALMON SURVEY

Laboratory: Ecology, Manchester

Sample No: 88 228141

Description: HUMPTULP

Begin Date: 88/05/24 :

B/N/Acid	Scan	Sediment	B/N/Acid	Scan	Sediment	Resin Acids	Guaiacol	Sediment
***	Continued	***	***	Continued	***	***	Continued	***
	Result	Units		Result	Units		Result	Units
Benzoic acid	360U	ug/kg	2, 4-Dichlorophenol	75U	ug/kg	4-Chloroguaiacol	75U	ug/kg
Hexachloroethane	75U	ug/kg	2, 4-Dinitrotoluene	75U	ug/kg	Surrog: Pyrene D10	42%	% Recov
Hexachlorocyclopentadiene	150U	ug/kg	Pyrene	75U	ug/kg	Surrog: 2-Fluoro, 1-methyl-	35%	% Recov
Isophorone	75U	ug/kg	Dimethylphthalate	75U	ug/kg	Surrog: 2-Fluorobiphenyl-	NAR	% Recov
Acenaphthene	75U	ug/kg	Dibenzo[urran	75U	ug/kg	Surrog: 2-Fluorophenol	22%	% Recov
Diethylphthalate	75BU	ug/kg	Benzo(ghi)perylene	75U	ug/kg	Surrog: Heptadecanoic +	96%	% Recov
Di-n-Butylphthalate	20BJ*	ug/kg	Indeno(1,2,3-cd)pyrene	75U	ug/kg	Surrog: D14-Terphenyl	42%	% Recov
Phenanthrene	75U	ug/kg	Benzo(b)fluoranthene	75U	ug/kg	Surrog: 2-Naphthoic ac+	48%	% Recov
Butylbenzylphthalate	75BU	ug/kg	Fluoranthene	75U	ug/kg	Surrog: D5-Nitrobenzene	19%	% Recov
N-Nitrosodiphenylamine	75U	ug/kg	Benzo(k)fluoranthene	75U	ug/kg	Surrog: D5-Phenol	66%	% Recov
Fluorene	75U	ug/kg	Acenaphthylene	75U	ug/kg	Surrog: o-Methylpodoca +	61%	% Recov
Carbazole	75U	ug/kg	Chrysene	75U	ug/kg			
Hexachlorobutadiene	75U	ug/kg	Retene	75U	ug/kg			
Pentachlorophenol	360U	ug/kg	4, 6-Dinitro-2-methylph +	360U	ug/kg	Misc GC Specified		
2, 4, 6-Trichlorophenol	75U	ug/kg	1, 3-Dichlorobenzene	75U	ug/kg			
2-Nitroaniline	360U	ug/kg	2, 6-Dinitrotoluene	75U	ug/kg			
2-Nitrophenol	75U	ug/kg	N-Nitroso-di-n-Propyl +	75U	ug/kg			
Naphthalene, 1-Methyl-	75U	ug/kg	4-Chlorophenyl-phenyle +	75U	ug/kg			
Naphthalene	75BU	ug/kg	bis(2-Chloroisopropyl) +	75U	ug/kg			
2-Methylnaphthalene	75U	ug/kg	Surrog: D10-Pyrene	93%	% Recov			
2-Chloronaphthalene	75U	ug/kg	Surrog: 2-Fluorobiphenyl	51%	% Recov			
3, 3'-Dichlorobenzidine	75U	ug/kg	Surrog: 2-Fluorophenol	50%	% Recov			
2-Methylphenol	75U	ug/kg	Surrog: D14-Terphenyl	107%	% Recov			
1, 2-Dichlorobenzene	75U	ug/kg	Surrog: D5-Nitrobenzene	41%	% Recov			
o-Chlorophenol	75U	ug/kg	Surrog: D5-Phenol	50%	% Recov			
2, 4, 5-Trichlorophenol	360U	ug/kg						
Nitrobenzene	75U	ug/kg						
3-Nitroaniline	360U	ug/kg						
4-Nitroaniline	360U	ug/kg						
4-Nitrophenol	360U	ug/kg						
Benzyl Alcohol	75U	ug/kg	Linoleic acid	75U	ug/kg	4, 4'-DDT	1U	ug/kg
4-Bromophenyl-phenyle +	75U	ug/kg	Guaicol (2-methoxyphen +	75U	ug/kg	Chlordane	1U	ug/kg
2, 4-Dimethylphenol	75U	ug/kg	4-Allylguaiacol (eugen +	75U	ug/kg	Gamma-BHC (Lindane)	1U	ug/kg
4-Methylphenol	75U	ug/kg	Oleic acid	76J*	ug/kg	Dieldrin	1U	ug/kg
1, 4-Dichlorobenzene	75U	ug/kg	Sandaracopimaric acid	75U	ug/kg	Endrin	1U	ug/kg
4-Chloroaniline	75U	ug/kg	Abietic acid	75U	ug/kg	4, 4'-DDD	1U	ug/kg
Phenol	75BU	ug/kg	Tetrachloroguaiacol	75U	ug/kg	4, 4'-DDE	1U	ug/kg
bis(2-Chloroethyl) Ether	75U	ug/kg	Guaiacol (2-methoxyphen +	75U	ug/kg	Heptachlor	1U	ug/kg
bis(2-Chloroethoxy) Met +	75U	ug/kg	4, 5, 6-Trichloroguaiacol	75U	ug/kg	Aldrin	1U	ug/kg
BIS(2-ETHYLHEXYL) PHTH +	57BJ*	ug/kg	9, 10-Dichlorosteric ac +	75U	ug/kg	alpha-BHC	1U	ug/kg
Di-n-Octyl Phthalate	75BU	ug/kg	Dichlorodehydroabietic +	75BU	ug/kg	beta-BHC	1U	ug/kg
Hexachlorobenzene	75U	ug/kg	Dehydroabietic acid	75U	ug/kg	delta-BHC	1U	ug/kg
Anthracene	75U	ug/kg	4, 5-Dichloroguaiacol	75U	ug/kg	alpha-Endosulfan	1U	ug/kg
1, 2, 4-Trichlorobenzene	75U	ug/kg	Trichlorosyringol	75U	ug/kg	Heptachlor epoxide	1U	ug/kg
			Isopimaric acid					

Source: Sediment (General)

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Washington State Department of Ecology
Sample/Project Analysis Results

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Project: DOE-541F GRAYS HARBOR SALMON SURVEY

Laboratory: Ecology, Manchester

Sample No: 88 228141

Description: HUMPTULP

Begin Date: 88/05/24

Pest/PCB	PP Scan	Sediment	Result	Units	
Endosulfan sulfate	1U	ug/kg			
Endrin aldehyde	1U	ug/kg			
Toxaphene	30U	ug/kg			
PCB - 1260	10U	ug/kg			
PCB - 1254	10U	ug/kg			
PCB - 1221	10U	ug/kg			
PCB - 1232	10U	ug/kg			
PCB - 1248	10U	ug/kg			
PCB - 1016	10U	ug/kg			
beta-Endosulfan	1U	ug/kg			
PCB - 1242	10U	ug/kg			
IntStd: Hexabromobenzene	86%	% Recov			

Officer: DXR Account: 41652

Source: Sediment (General)

(Sample Complete)

Project: DOE-541F GRAYS HARBOR SALMON SURVEY

Blank ID: 88ABS8230

Account: 41652

Officer: DXR

	VOA - PP Scan (GCMS)	Sediment Result	Units	VOA - PP Scan (GCMS)	Scan (GCMS) *** Continued	Sediment Result	Units
	Blank #1			Blank #1			
Carbon Tetrachloride	5U	ug/kg		1, 3, 5-Trimethylbenzene	5U	ug/kg	
Acetone	2J*	ug/kg		Bromobenzene	5U	ug/kg	
Chloroform	5U	ug/kg		Toluene	0.3J*	ug/kg	
Benzene	5U	ug/kg		Chlorobenzene	5U	ug/kg	
1,1,1-Trichloroethane	5U	ug/kg		1, 2, 4-Trichlorobenzene	5U	ug/kg	
Bromomethane	10U	ug/kg		Dibromochloromethane	5U	ug/kg	
Chloromethane	10U	ug/kg		Tetrachloroethene	5U	ug/kg	
Dibromomethane	5U	ug/kg		Sec-Butylbenzene	5U	ug/kg	
Bromoform	10U	ug/kg		1, 3-Dichloroproppane	5U	ug/kg	
Chloroethane	10U	ug/kg		Cis-1, 2-Dichloroethene	5U	ug/kg	
Vinyl Chloride	7 *	ug/kg		trans-1, 2-Dichloroethene+	5U	ug/kg	
Methylene Chloride	5U	ug/kg		1, 3-Dichlorobenzene	5U	ug/kg	
Carbon Disulfide	5U	ug/kg		1, 1-Dichloropropene	5U	ug/kg	
Bromodichloromethane	5U	ug/kg		2, 2-Dichloropropene	5U	ug/kg	
1,1-Dichloroethane	5U	ug/kg		2-Hexanone	10U	ug/kg	
1,1-Dichloroethene	5U	ug/kg		Ethane, 1, 1, 1, 2-Tetrac+	5U	ug/kg	
Trichlorofluoromethane	5U	ug/kg		cis-1, 3-Dichloropropene	5U	ug/kg	
Methane, Dichlorodiflu+	10U	ug/kg		trans-1, 3-Dichloropropene	5U	ug/kg	
1, 2-Dichloropropane	5U	ug/kg		Surrog: D4-1, 2-Dichlor+	104 %	% Recov	
2-Butanone	0.6J*	ug/kg		Surrog: 1, 4-BromoFluor+	94 %	% Recov	
1, 1, 2-Trichloroethane	5U	ug/kg		Surrog: D8-Toluene	99 %	% Recov	
Trichloroethene	5U	ug/kg					
1, 1, 2, 2-Tetrachloroeth+	5U	ug/kg					
1, 2, 3-Trichlorobenzene	5U	ug/kg					
Hexachlorobutadiene	5U	ug/kg					
Naphthalene	5U	ug/kg					
Total Xylenes	5U	ug/kg					
2-Chlorotoluene	5U	ug/kg					
1, 2-Dichlorobenzene	5U	ug/kg					
1, 2, 4-Trimethylbenzene	5U	ug/kg					
DBCP	5U	ug/kg					
1, 2, 3-Trichloropropane	5U	ug/kg					
Tert-Butylbenzene	5U	ug/kg					
Isopropylbenzene (Cumene)	5U	ug/kg					
p-Isopropyltoluene	5U	ug/kg					
Ethylbenzene	5U	ug/kg					
Styrene	5U	ug/kg					
Benzene, Propyl-	5U	ug/kg					
Butylbenzene	5U	ug/kg					
4-Chlorotoluene	5U	ug/kg					
1, 4-Dichlorobenzene	5U	ug/kg					
1, 2-Dibromoethane (EDB)	10U	ug/kg					
1, 2-Dichloroethane	5U	ug/kg					
Vinyl Acetate	10U	ug/kg					
4-Methyl-2-Pentanone	10U	ug/kg					

(Sample Complete)

Project: DOE-541F GRAYS HARBOR SALMON SURVEY

Blank ID: 88ABS8232

Officer: DXR

Account: 41652

	VOA - PP Scan (GCMS)	Sediment Result	PP Scan (GCMS) ***	Scan (GCMS) Continued	Sediment ***	
	Blank #1	Units	Blank #1	Blank #1	Result	Units
Carbon Tetrachloride	5U	ug/kg	2J*	1, 3 , 5-Trimethylbenzene	5U	ug/kg
Acetone	2J*	ug/kg	5U	Bromobenzene	5U	ug/kg
Chloroform	5U	ug/kg	5U	Toluene	0 . 3 J *	ug/kg
Benzene	5U	ug/kg	5U	Chlorobenzene	5U	ug/kg
1,1,1-Trichloroethane	5U	ug/kg	10U	1, 2 , 4-Trichlorobenzene	5U	ug/kg
Bromomethane	10U	ug/kg	5U	Dibromochloromethane	5U	ug/kg
Chloromethane	5U	ug/kg	5U	Tetrachloroethene	5U	ug/kg
Dibromomethane	5U	ug/kg	10U	Sec-Butylbenzene	5U	ug/kg
Chloroethane	10U	ug/kg	10U	1, 3-Dichloropropane	5U	ug/kg
Vinyl Chloride	4J*	ug/kg	5U	Cis-1 , 2-Dichloroethene	5U	ug/kg
Methylene Chloride	5U	ug/kg	5U	trans-1 , 2-Dichloroethene+	5U	ug/kg
Carbon Disulfide	5U	ug/kg	5U	1 , 3-Dichlorobenzene	5U	ug/kg
Bromoform	5U	ug/kg	5U	1 , 1-Dichloropropane	5U	ug/kg
Bromodichloromethane	5U	ug/kg	5U	2 , 2-Dichloropropane	5U	ug/kg
1,1-Dichloroethane	5U	ug/kg	5U	2-Hexanone	10U	ug/kg
1,1-Dichloroethene	5U	ug/kg	5U	Ethane , 1 , 1 , 1 , 2-Tetrac+	5U	ug/kg
Trichlorofluoromethane	5U	ug/kg	10U	cis-1 , 3-Dichloropropene	5U	ug/kg
Methane , Dichlorodiflu+	5U	ug/kg	5U	trans-1 , 3-Dichloroprop+	5U	ug/kg
1 , 2-Dichloropropane	5U	ug/kg	0 . 7 J *	Surrog: D4-1 , 2-Dichlor+	107%	% Recov
2-Butanone	5U	ug/kg	5U	Surrog: 1 , 4-Bromofluor+	94%	% Recov
1,1,2-Trichloroethane	5U	ug/kg	5U	Surrog: D8-Toluene	103%	% Recov
1,1,2,2-Tetrachloroethene	5U	ug/kg	5U			
1,1,2,3-Trichlorobenzene	5U	ug/kg	5U			
Hexachlorobutadiene	5U	ug/kg	5U			
Naphthalene	5U	ug/kg	5U			
Total Xylenes	5U	ug/kg	5U			
2-Chlororobtoluene	5U	ug/kg	5U			
1,2,4-Trimethylbenzene	5U	ug/kg	5U			
DBCP	5U	ug/kg	5U			
1,2,3-Trichloropropane	5U	ug/kg	5U			
Tert-Butylbenzene	5U	ug/kg	5U			
Isopropenylbenzene (Cune +	5U	ug/kg	5U			
p-Isopropyltoluene	5U	ug/kg	5U			
Ethylibenzene	5U	ug/kg	5U			
Styrene	5U	ug/kg	5U			
Benzene , Propyl-	5U	ug/kg	5U			
Butylibenzene	5U	ug/kg	5U			
4-Chlorotoluene	5U	ug/kg	5U			
1 , 4-Dichlorobenzene	5U	ug/kg	10U			
1 , 2-Dibromoethane (EDB)	5U	ug/kg	5U			
1 , 2-Dichloroethane	10U	ug/kg	10U			
Vinyl Acetate	10U	ug/kg	10U			
4-Methyl-2-Pentanone	10U	ug/kg				

(Sample Complete)

Project: DOE-541F GRAYS HARBOR SALMON SURVEY

Blank ID: A88ABS8231

	VOA - PP Scan (GCMS)	Sediment	VOA - PP Scan (GCMS)	Scan	(GCMS)	Sediment
	Blank #1	Result Units	Blank #1	***	Continued	***
Carbon Tetrachloride	5U ug/kg		1,3,5-Trimethylbenzene	5U	ug/kg	
Acetone	2J* ug/kg		Bromobenzene	5U	ug/kg	
Chloroform	5U ug/kg		Toluene	0 .2J*	ug/kg	
Benzene	5U ug/kg		Chlorobenzene	5U	ug/kg	
1,1,1-Trichloroethane	5U ug/kg		1,2,4-Trichlorobenzene	5U	ug/kg	
Bromomethane	10U ug/kg		Dibromochloromethane	5U	ug/kg	
Chloromethane	10U ug/kg		Tetrachloroethene	5U	ug/kg	
Dibromomethane	5U ug/kg		Sec-Butylbenzene	5U	ug/kg	
Chloroethane	10U ug/kg		1,3-Dichloropropane	5U	ug/kg	
Vinyl Chloride	10U ug/kg		Cis-1,2-Dichloroethene	5U	ug/kg	
Methylene Chloride	4J* ug/kg		trans-1,2-Dichloroethene+	5U	ug/kg	
Carbon Disulfide	5U ug/kg		1,3-Dichlorobenzene	5U	ug/kg	
Bromoform	5U ug/kg		1,1-Dichloropropane	5U	ug/kg	
Bromodichloromethane	5U ug/kg		2,2-Dichloropropane	5U	ug/kg	
1,1-Dichloroethane	5U ug/kg		2-Hexanone	10U	ug/kg	
1,1-Dichloroethene	5U ug/kg		Ethane	1,1,1,2-Tetra-		
Trichlorofluoromethane	10U ug/kg		cis-1,3-Dichloropropene	5U	ug/kg	
Methane, Dichlorodiflu+	5U ug/kg		trans-1,3-Dichloropropene	5U	ug/kg	
1,2-Dichloropropane	0 .6J* ug/kg		Surrog: D4-1,2-Dichlor+	114 %	% Recov	
2-Butane	5U ug/kg		Surrog: 1,4-Bromofluor+	95 %	% Recov	
1,1,2-Trichloroethane	5U ug/kg		Surrog: D8-Toluene	99 %	% Recov	
Trichloroethene	5U ug/kg					
1,1,2,2-Tetrachloroeth-	5U ug/kg					
1,2,3-Trichlorobenzene	5U ug/kg					
Hexachlorobutadiene	5U ug/kg					
Naphthalene	5U ug/kg					
Total Xylenes	5U ug/kg					
2-Chlorotoluene	5U ug/kg					
1,2-Dichlorobenzene	5U ug/kg					
1,2,4-Trimethylbenzene	5U ug/kg					
DBCP	5U ug/kg					
1,2,3-Trichloropropane	5U ug/kg					
Tert-Butylbenzene	5U ug/kg					
Isopropylbenzene (Cumu+ p-Isopropyltoluene	5U ug/kg					
Ethylibenzene	5U ug/kg					
Styrene, Propyl-	5U ug/kg					
Butylbenzene	5U ug/kg					
4-Chlorotoluene	5U ug/kg					
1,4-Dichlorobenzene	5U ug/kg					
1,2-Dibromoethane (EDB)	10U ug/kg					
1,2-Dichloroethane	5U ug/kg					
Vinyl Acetate	10U ug/kg					
4-Methyl-2-Pentanone	10U ug/kg					

(Sample Complete)

Project : DOE-541F Grays Harbor Salmon Survey

Rank ID: BN8155

Officer: DXR Account: 41652

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Project: DOE-541F GRAYS HARBOR SALMON SURVEY

Blank ID: BN8155SJ

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Account: 41652

Officer: DXR

B/N/Acid Scan	Sediment			Sediment			Pest/PCB - PP Scan	Sediment	
	Result	Units	Blank #2	Result	Units	Blank #1	Continued ***	Result	Units
Benzo(a)Pyrene	110U	ug/kg		Di-n-Octyl Phthalate	15BJ*	ug/kg			
2,4-Dinitrophenol	530U	ug/kg		Hexachlorobenzene	110U	ug/kg	beta-BHC	UND	ug/kg
Dibenz(a,h)anthracene	110U	ug/kg		Anthracene	110U	ug/kg	delta-BHC	UND	ug/kg
Benzo(a)anthracene	110U	ug/kg		1,2,4-Trichlorobenzene	110U	ug/kg	alpha-Endosulfan	UND	ug/kg
4-Chloro-3-Methylphenol	110U	ug/kg		2,4-Dichlorophenol	110U	ug/kg	Heptachlor epoxide	UND	ug/kg
Benzoic acid	530U	ug/kg		2,4-Dinitrotoluene	110U	ug/kg	Endosulfan sulfate	UND	ug/kg
Hexachloroethane	110U	ug/kg		Pyrene	110U	ug/kg	Endrin aldehyde	UND	ug/kg
Hexachlorocyclopentadi-	220U	ug/kg		Dimethylphthalate	110U	ug/kg	Toxaphene	UND	ug/kg
Isophorone	110U	ug/kg		Dimethylbenzofuran	110U	ug/kg	PCB - 1260	UND	ug/kg
Acenaphthene	110U	ug/kg		Benzo(g,h,i)Perylene	110U	ug/kg	PCB - 1254	UND	ug/kg
Acenaphthiphthalate	110BU	ug/kg		Indeno(1,2,3-cd)pyrene	110U	ug/kg	PCB - 1221	UND	ug/kg
Di-n-Butylphthalate	37BJ*	ug/kg		Benzo(b)fluoranthene	110U	ug/kg	PCB - 1232	UND	ug/kg
Phenanthrene	110U	ug/kg		Fluoranthene	110U	ug/kg	PCB - 1248	UND	ug/kg
Butylbenzylphthalate	110BU	ug/kg		Benzo(k)fluoranthene	110U	ug/kg	PCB - 1016	UND	ug/kg
N-Nitrosodiphenylamine	110U	ug/kg		Acenaphthylene	110U	ug/kg	beta-Endosulfan	UND	ug/kg
Fluorene	110U	ug/kg		Chrysene	110U	ug/kg	PCB - 1242	UND	ug/kg
Carbazole	110U	ug/kg		Retene	110U	ug/kg	Int Std: Hexabromobenzene	73%	% Recov
Hexachlorobutadiene	530U	ug/kg		4,6-Dinitro-2-methylphenol	530U	ug/kg			
Pentachlorophenol	110U	ug/kg		2,6-Dichlorobenzene	110U	ug/kg			
2,4,6-Trichlorophenol	530U	ug/kg		1,3-Dichlorobenzene	110U	ug/kg			
2-Nitroaniline	110U	ug/kg		2,6-Dinitrotoluene	110U	ug/kg			
2-Nitrophenol	530U	ug/kg		N-Nitroso-di-n-Propylate	110U	ug/kg			
Naphthalene, 1-Methyl-	110U	ug/kg		4-Chlorophenyl-phenylet-	110U	ug/kg			
Naphthalene	4BJ*	ug/kg		bis(2-Chloroisopropyl) +	110U	ug/kg			
2-Methylnaphthalene	110U	ug/kg		Surrog: D10-Pyrene	134%	% Recov			
2-Chloronaphthalene	110U	ug/kg		Surrog: 2-Fluorobiphenyl	66%	% Recov			
3,3'-Dichlorobenzidine	110U	ug/kg		Surrog: 2-Fluorophenol	62%	% Recov			
2-Methylphenol	110U	ug/kg		Surrog: D14-Terphenyl	150%	% Recov			
1,2-Dichlorobenzene	110U	ug/kg		Surrog: D5-Nitrobenzene	49%	% Recov			
o-Chlorophenol	110U	ug/kg		Surrog: D5-Phenol	53%	% Recov			
2,4,5-Trichlorophenol	530U	ug/kg							
Nitrobenzenes	110U	ug/kg							
3-Nitroaniline	530U	ug/kg							
4-Nitroaniline	530U	ug/kg							
4-Nitropheno	530U	ug/kg							
Benzyl Alcohol	110U	ug/kg							
4-Bromophenyl-phenylet+	110U	ug/kg		4,4'-DDT	UND	ug/kg			
2,4-Dimethylphenol	110U	ug/kg		Chlordane	UND	ug/kg			
4-Methylphenol	110U	ug/kg		gamma-BHC (Lindane)	UND	ug/kg			
1,4-Dichlorobenzene	110U	ug/kg		Dieldrin	UND	ug/kg			
4-Chloroaniline	110U	ug/kg		Endrin	UND	ug/kg			
Phenol	110BU	ug/kg		4,4'-DDD	UND	ug/kg			
bis(2-Chloroethoxy)Ether	110U	ug/kg		4,4'-DDE	UND	ug/kg			
bis(2-Chloroethoxy)Methyl	110U	ug/kg		Heptachlor	UND	ug/kg			
BIS(2-ETHYLHEXYL) PHTH+	100BJ*	ug/kg		Aldrin	UND	ug/kg			
				alpha-BHC	UND	ug/kg			

(Sample Complete)

18-SEP-89
12:20:33

Washington State Department of Ecology
Sample/Project Analysis Results

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Project: DOE-541F GRAYS HARBOR SALMON SURVEY

Blank ID: BN81655R

Officer: DXR
Account: 41652

Misc GC Specified	Sediment
Blank #1	Result Units
Aldicarb	UND ug/kg
Simazine	UND ug/kg
Diuron	UND ug/kg
Atrazine	UND ug/kg
Butylate	UND ug/kg
Metribuzin	UND ug/kg
Fenamiphos	UND ug/kg
Pronamide	UND ug/kg
Hexazinone	UND ug/kg

18-SEP-89
12:20:33

Washington State Department of Ecology
Sample/Project Analysis Results

Project: DOE-541F GRAYS HARBOR SALMON SURVEY

Blank ID: BS8155JM

	Resin Acids	Guaiacol	Sediment	
Blank #1			Result	Units
Linoleic acid		110U	ug/kg	
Guaico 1 (2-methoxyphen+		110U	ug/kg	
4-Allylguaiacol (eugen+		110U	ug/kg	
Oleic acid		110U	ug/kg	
Sandaracopimamic acid		110U	ug/kg	
Abietic acid		110U	ug/kg	
Tetrachloroguaiacol		110U	ug/kg	
4,5,6-Trichloroguaiacol		110U	ug/kg	
9,10-Dichlorosteric ac+		110U	ug/kg	
Dichlorodehydroabietic +		110U	ug/kg	
Dehydroabietic acid		5J*	ug/kg	
4,5-Dichloroguaiacol		110U	ug/kg	
Trichlorosyringol		110U	ug/kg	
Isopimaric acid		110U	ug/kg	
4-Chloroguaiacol		110U	ug/kg	
Surrog: Pyrene D10		24%	% Recov	
Surrog: 2-Fluoro, 1-met+		1.3%	% Recov	
Surrog: 2-Fluorobiphen+		85%	% Recov	
Surrog: 2-Fluoropheno1		12%	% Recov	
Surrog: Heptadecanoic +		45	% Recov	
Surrog: D14-Terphenyl		24%	% Recov	
Surrog: 2-Naphthoic ac+		14	% Recov	
Surrog: D5-Nitrobenzene		9%	% Recov	
Surrog: D5-Phenol		13%	% Recov	
Surrog: o-Methylpodoca+		36	% Recov	

Project: DOE-541F GRAYS HARBOR SALMON SURVEY

Blank ID: BS8155M

Officer: DXR
Account: 41652

	Resin Acids	Guaiacol	Sediment	Result	Units
	Blank #1				
Linoleic acid			110U	ug/kg	
Guaicol (2-methoxyphen+ 4-Allylguaiacol (eugen+ Oleic acid)			110U	ug/kg	
Sandaracopimaric acid			110U	ug/kg	
Abietic acid			110U	ug/kg	
Tetrachloroguaicol			110U	ug/kg	
4,5,6-Trichloroguaicol			110U	ug/kg	
9,10-Dichlorosteric ac+			110U	ug/kg	
Dichlorodehydroabietic +			110U	ug/kg	
Dehydروabietic acid			110U	ug/kg	
4,5-Dichloroguaiacol			110U	ug/kg	
Trichlorosyringol			110U	ug/kg	
Isopimamic acid			110U	ug/kg	
4-Chloroguaiacol			110U	ug/kg	
Surrog: Pyrene D10			25%	% Recov	
Surrog: 2-Fluorobiphen+			21%	% Recov	
Surrog: 2-Fluorophenol			12%	% Recov	
Surrog: Heptadecanoic +			55	% Recov	
Surrog: D14-Terphenyl			48%	% Recov	
Surrog: 2-Naphthoic ac+			20	% Recov	
Surrog: D5-Nitrobenzene			13%	% Recov	
Surrog: D5-Phenol			NAR	% Recov	
Surrog: o-MethylPodoca+			39	% Recov	

Appendix B. (Continued)

<u>Metals and Cyanide Spike Recoveries (%)</u>			
<u>Constituent</u>	<u>Spike #1</u>	<u>Spike #2</u>	<u>Sample No.</u>
ICP Analysis:			
Be	98	98	228141
Cd	95	95	228141
Cr	96	96	228141
Cu	98	98	228141
Pb	93	93	228141
Ni	96	96	228141
Zn	99	99	228141
AA Analysis:			
Ag	102	102	228140
Pb	96	99	228140
Hg	109	110	228140
Se	104	102	228140
As	86	92	228140
Sb	102	94	228140
Th	108	104	228140
Cyanide Analysis:			
CN	103	---	228138
CN	93	---	228141

POLYCHLORINATED DIOXINS/FURANS



QUALITY CONTROL SUMMARY

Client Name: State of Washington Dept. of Ecology
Client ID: 228142 Native Spike (=Weyerhaeuser outfall #22-8133)
Lab ID: 041719-001NS Enseco ID: NA
Matrix: Sediment Sampled: Not Given Received: 26-May-88
Authorized: 26-May-88 Prepared: 09-Jun-88 Analyzed: 06-Jul-88

Sample Amount: 10.0 g
Column Type: DB-5

<u>Parameters</u>	Total pg Found in Sample	Total pg Spiked	Total pg Found in NS Sample	% Recovery
-------------------	--------------------------	-----------------	-----------------------------	------------

Furans

Tetra (total)	ND	200	180	90
Penta (total)	ND	500	340	68
Hexa (total)	ND	500	670	140
Hepta (total)	ND	500	340	68
Octa (total)	ND	1000	1500	150

Dioxins

Tetra (total)	ND	200	130	65
Penta (total)	ND	500	450	90
Hexa (total)	ND	500	420	84
Hepta (total)	250	500	530	56
Octa (total)	1200	1000	2400	120

% Recovery

13C-2,3,7,8-TCDF	44
13C-2,3,7,8-TCDD	78
13C-1,2,3,7,8-PeCDD	52
13C-1,2,3,6,7,8-HxCDD	49
13C-1,2,3,4,6,7,8-HpCDD	39
13C-OCDD	19

ND=Not Detected
 NA=Not Applicable

Reported by: KA

Approved by: JP

The cover letter is an integral part of this report.
 Version 070187

POLYCHLORINATED DIOXINS/FURANS

QUALITY CONTROL SUMMARY

Client Name: State of Washington Dept. of Ecology
Client ID: 228142 Native Spike Duplicate (=Weyerhaeuser outfall #22-8133)
Lab ID: 041719-001NSD Enseco ID: NA
Matrix: Sediment Sampled: Not Given Received: 26-May-88
Authorized: 26-May-88 Prepared: 09-Jun-88 Analyzed: 05-Jul-88

Sample Amount: 10.1g
Column Type: DB-5

<u>Parameters</u>	Total pg Found in Sample	Total pg Spiked	Total pg Found in NS Sample	% Recovery
-------------------	--------------------------	-----------------	-----------------------------	------------

Furans

Tetra (total)	ND	200	170	85
Penta (total)	ND	500	320	64
Hexa (total)	ND	500	630	130
Hepta (total)	ND	500	330	66
Octa (total)	ND	1000	1000	100

Dioxins

Tetra (total)	ND	200	180	90
Penta (total)	ND	500	510	100
Hexa (total)	ND	500	540	110
Hepta (total)	250	500	570	64
Octa (total)	1200	1000	2400	120

% Recovery

13C-2,3,7,8-TCDF	43
13C-2,3,7,8-TCDD	65
13C-1,2,3,7,8-PeCDD	52
13C-1,2,3,6,7,8-HxCDD	51
13C-1,2,3,4,6,7,8-HpCDD	42
13C-OCDD	23

ND=Not Detected

NA=Not Applicable

Reported by: KA

Approved by:

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POLYCHLORINATED DIOXINS/FURANS
ISOMER SPECIFIC ANALYSIS
HIGH RESOLUTIONClient Name: State of Washington Dept. of Ecology
Client ID: 228142 (=Weyerhaeuser outfall #22-8133)

Lab ID: 041719-0001-SA Enseco ID: 54456

Matrix: Sediment Sampled: Not Given

Received: 26 MAY 88

Authorized: 25 MAY 88 Prepared: 09 JUN 88

Analyzed: 05 JUL 88

Sample Amount 10.2 g
Percent Moisture NA

% Recovery

13C-2,3,7,8-TCDF	48
13C-2,3,7,8-TCDD	54
13C-1,2,3,7,8-PeCDD	49
13C-1,2,3,6,7,8-HxCDD	50
13C-1,2,3,4,6,7,8-HpCDD	42
13C-OCDD	20

ND=Not Detected
NA=Not Applicable

Reported By: Renee Barry

Approved By: Bill Luksemburg

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POLYCHLORINATED DIOXINS/FURANS
ISOMER SPECIFIC ANALYSIS
HIGH RESOLUTION

Client Name: State of Washington Dept. of Ecology
Client ID: 228143 (=ITT outfall #22-8137)

Lab ID: 041719-0002-SA Enseco ID: 54457

Matrix: Sediment Sampled: Not Given

Authorized: 25 MAY 88 Prepared: 09 JUN 88

Received: 26 MAY 88

Analyzed: 05 JUL 88

Sample Amount 10.1 g
Percent Moisture NA

% Recovery

13C-2,3,7,8-TCDF	43
13C-2,3,7,8-TCDD	52
13C-1,2,3,7,8-PeCDD	52
13C-1,2,3,6,7,8-HxCDD	52
13C-1,2,3,4,6,7,8-HpCDD	46
13C-OCDD	22

ND=Not Detected

NA=Not Applicable

Reported By: Pat Buddrus

Approved By: Bill Luksemburg

The cover letter is an integral part of this report.

POLYCHLORINATED DIOXINS/FURANS
ISOMER SPECIFIC ANALYSIS
HIGH RESOLUTION

Client Name: State of Washington Dept. of Ecology
Client ID: 228144 (=Cow Point #22-8132)
Lab ID: 041719-0003-SA Enseco ID: 54458
Matrix: Sediment Sampled: Not Given
Authorized: 25 MAY 88 Prepared: 09 JUN 88

Received: 26 MAY 88
Analyzed: 05 JUL 88

Sample Amount 10.1 g
Percent Moisture NA

% Recovery

13C-2,3,7,8-TCDF	41
13C-2,3,7,8-TCDD	60
13C-1,2,3,7,8-PeCDD	52
13C-1,2,3,6,7,8-HxCDD	48
13C-1,2,3,4,6,7,8-HpCDD	38
13C-OCDD	18

ND=Not Detected
NA=Not Applicable

Reported By: Pat Buddrus

Approved By: Bill Luksemburg

The cover letter is an integral part of this report.

**POLYCHLORINATED DIOXINS/FURANS
ISOMER SPECIFIC ANALYSIS**

Client Name: State of Washington Dept. of Ecology

Client ID: Method Blank

Lab ID: 041719-MB

Enseco ID: NA

Matrix: Sediment

Sampled: NA

Received: NA

Authorized: NA

Prepared: 09-Jun-88

Analyzed: 05-Jul-88

Sample Amount: 10.0 g

<u>Parameter</u>	<u>Result</u>	<u>Units</u>	<u>Detection Limit</u>
Furans			
Tetra (total)	ND	pg/g	0.30
(2378)	ND	pg/g	0.30
Penta (total)	ND	pg/g	0.48
(12378)	ND	pg/g	0.48
(23478)	ND	pg/g	0.48
Hexa (total)	ND	pg/g	0.46
(123478)	ND	pg/g	0.46
(123678)	ND	pg/g	0.46
(234678)	ND	pg/g	0.46
(123789)	ND	pg/g	0.46
Hepta (total)	ND	pg/g	0.99
(1234678)	ND	pg/g	0.99
(1234789)	ND	pg/g	0.99
Octa (total)	ND	pg/g	4.2
Dioxins			
Tetra (total)	ND	pg/g	0.69
(2378)	ND	pg/g	0.69
Penta (total)	ND	pg/g	3.1
(12378)	ND	pg/g	3.1
Hexa (total)	ND	pg/g	2.2
(123478)	ND	pg/g	2.2
(123678)	ND	pg/g	2.2
(123789)	ND	pg/g	2.2
Hepta (total)	ND	pg/g	1.3
(1234678)	ND	pg/g	1.3
Octa (total)	ND	pg/g	2.1

% Recovery

13C-TCDF	62
13C-TCDD	72
13C-PnCDD	68
13C-HxCDD	63
13C-HpCDD	48
13C-OCDD	25

ND=Not Detected

NA=Not Applicable

Reported by: KA

Approved by: *MJM*

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APPENDIX C

Results from Analysis of EPA 1988 Suspended Matter Samples

Appendix C. Results from Analysis of EPA 1988 Suspended Matter Samples

During the two weeks following Ecology's survey of Grays Harbor bottom sediments, EPA conducted a pilot study to assess the occurrence of toxic chemicals in the Grays Harbor water column. For this study, suspended matter was analyzed to obtain information on current inputs of contaminants to the estuary and as a means of increasing analytical sensitivity to detect organic compounds that may be present at sub-parts per billion levels and thus escape detection during analysis of whole water. Based on experience gained with this method, a second series of suspended matter samples was collected by EPA and Ecology during the salmon survival studies conducted in 1989 using an improved sampling system and some revised analytical techniques. A brief qualitative comparison of the 1988 suspended matter and bottom sediment data follows.

Particulates were collected during coho smolt field exposure experiments by pumping water through a continuous centrifuge mounted on barges which moved smolts around inner Grays Harbor and North Bay. Samples were obtained in the upper estuary between Cosmopolis and Cow Point (three samples), in the North and South Chehalis River Channels (one sample each), and in outer North Bay (one sample). Results from analysis of these samples by the EPA/Ecology Manchester Laboratory (Hornig, 1988, unpublished data) are summarized in Table C-1 and compared to Ecology data on bottom sediments from similar parts of the estuary.

Allowing for differences in detection limits, metals analysis of suspended matter and bottom sediments from Grays Harbor detected similar concentrations of most metals. The concentrations of major constituents such as chromium, copper, and zinc agreed especially closely. Except for one high value for silver (2.5 mg/Kg), none of the particulate samples had metals concentrations that were substantially above the highest values measured in the bottom sediments.

With few exceptions, the organic priority pollutants and HSL compounds detected in suspended matter were also detected in the sediments; i.e., PAH, phenol, 4-methylphenol, retene, dibenzofuran, nitrosodiphenylamine, and PAE. PAE and phenol were laboratory contaminants in both sets of analyses. Nitrosodiphenylamine, which was detected in all suspended matter samples, was also detected in method blanks analyzed concurrently. Neither suspended matter nor bottom sediments contained detectable concentrations of OC pesticides or PCBs. Resin acids, guaiacols, and fatty acids detected in common during analysis of suspended matter and bottom sediments were dehydroabietic, oleic, and linoleic acids.

Organic compounds detected only in suspended matter included several high molecular weight PAH, butylbenzylphthalate, isophorone (also detected in North Bay), pentachlorophenol, 2,3,7,8-TCDD, hexazinone, 2,3,4,5-tetrachlorophenol, and triphenylphosphate, the two last-named compounds not being analyzed in the bottom sediments. Of these, the PAH compounds and butylbenzylphthalate are routinely detectable in Puget Sound sediments (Tetra Tech, 1986a, 1988a). The occurrence of TCDD and similar compounds in Grays Harbor is discussed elsewhere in this report.

Table C-1. Comparison of Analysis of EPA Suspended Matter Samples and Ecology Bottom Sediment Samples Collected in Grays Harbor Estuary
May 1988 (metals in mg/Kg, dry wt.; ppm -- organics in ug/Kg, dry wt.; ppb)

Chemical	Grays Harbor: Cosmopolis to Lower N and S Chehalis R. Channels			N. Bay: Inside Damon Pt.			N. Bay: Humptulips R. Channel Bottom Sediments (n=1); Concentration		
	Suspended Matter:		Bottom Sediments: Detection Concentration		N. Bay: Inside Damon Pt. Suspended Matter (n=1); Concentration				
	Frequency Range		Frequency Range		Frequency Range				
Metals:									
antimony	5/5	0.02	-	0.06	0/9	0.1U	-	-	0.1U
arsenic	3/5	0.01U	-	4.9	9/9	3.4	-	4.8	NA
beryllium	NA				9/9	0.7	-	1.1	NA
cadmium	4/5	0.07	-	0.5U	1/9	0.5U	-	0.9	0.5U
chromium	5/5	27.0	-	40.1	9/9	16.3	-	35.0	20.1
copper	5/5	19.1	-	57.1	9/9	19.3	-	59.0	30.6
lead	4/5	3.8	-	5.3	7/10	0.5U	-	5.1	0.5U
mercury	1/5	0.02U	-	0.037	9/9	0.014	-	0.081	0.017
nickel	5/5	18.2	-	28.6	9/9	45.7	-	64.0	56.3
selenium	3/5	0.07U	-	0.56	9/9	0.1	-	1.2	0.8
silver	5/5	0.04	-	2.7	2/9	0.02U	-	0.33	0.02U
thallium	5/5	0.04	-	0.1	0/9	0.1U	-	0.33	0.1U
zinc	5/5	43.8	-	93.8	9/9	51.6	-	80.8	60.3
Volatiles:									
carbon disulfide	NA				1/9	2U	-	8J	NA
acetone	NA				1/9	4U	-	130	NA
2-butanone	NA				1/9	1BU	-	21B	NA
methylene chloride	NA				1/9	4BU	-	77B	NA
trichlorofluoromethane	NA				0/9	6U	-	12U	NA
Low Molecular Weight PAH:									
naphthalene	5/5	45J	-	93J	7/9	17BJ	-	120BU	25J
1-methyl naphthalene	2/5	17J	-	300U	1/9	20J	-	130U	75BU
2-methyl naphthalene	3/5	7J	-	17J	4/9	9J	-	130U	75U
acenaphthylene	4/5	13J	-	18J	4/9	4J	-	130U	75U
acenaphthene	0/5	240U	-	340U	3/9	30J	-	130U	910U
fluorene	3/5	12J	-	19J	5/9	10J	-	130U	910U
phenanthrene	5/5	93J	-	180J	7/9	30J	-	530	75U
anthracene	0/5	300U	-	340U	2/9	15J	-	130U	910U
High Molecular Weight PAH:									
fluoranthene	5/5	140J	-	210J	8/9	57J	-	840	31J
pyrene	5/5	93J	-	160J	8/9	71U	-	640	30J
benzo(a)anthracene	2/5	51J	-	240U	4/9	16J	-	130U	910U
chrysene	3/5	36J	-	52J	2/9	18J	-	130U	910U
benzo(b)fluoranthene	1/5	85J	-	430U	2/9	20J	-	130U	910U
benzo(k)fluoranthene	2/5	36J	-	300U	0/9	76U	-	130U	910U
benzo(a)pyrene	1/5	300U	-	860	0/9	71U	-	130U	910U
benzo(ghi)perylene	1/5	54J	-	340U	0/9	71U	-	130U	910U
indeno(1,2,3-cd)pyrene	1/5	54J	-	340U	0/9	71U	-	130U	910U
Phthalates:									
di-n-butylphthalate	1/5	21BJ	-	340BU	7/9	13BJ	-	35BJ	20BJ
di-n-octylphthalate	3/5	140BJ	-	340BU	3/9	15BJ	-	510B	75BU
bis(2-ethylhexyl)phthalate	5/5	360BJ	-	820B	9/9	45BJ	-	610B	55BJ
butylbenzylphthalate	1/5	190J	-	340U	0/9	71BU	-	130BU	75BU
Phenols:									
phenol	3/5	24BJ	-	52BJ	2/9	16BJ	-	24BJ	910U
4-methylphenol	1/5	190J	-	300U	5/9	46J	-	520	910U

Table C-1. (Continued)

Chemical	Grays Harbor: Cosmopolis to Lower N and S Chehalis R. Channels			N. Bay: Inside Damon Pt. Suspended Matter (n=1): Concentration			N. Bay: Humptulips R. Channel Bottom Sediments (n=1): Concentration		
	Suspended Matter:	Bottom Sediments:		Detection Concentration		Frequency Range			
	Detection Concentration	Frequency Range							
Miscellaneous Extractables:									
retene	3/5	350 -	530	8/9	64J	- 540	910U	75U	
dibenzofuran	3/5	19J -	26J	5/9	19J	- 31J	910U	75U	
N-nitrosodiphenylamine	5/5	17BJ-	190BJ	1/9	12J	- 130U	910U	75U	
isophorone	5/5	16J -	46J	0/9	71U	- 130U	71J	75U	
OC Pesticides:									
PCBs:	0/5	10U		0/9	1U		NA	1U	
Cyanide:	NA			0/9	30U	- 60U	NA	10U	
Resin Acids:									
abietic acid	0/5	240U -	340U	4/9	29J	- 130J	NA	75U	
dehydoroabietic acid	5/5	240J -	1200	9/9	16BJ	- 830B	NA	75BU	
dichlorodehydroabietic acid	NA			2/9	70J	- 80J	NA	75U	
isopimaric acid	0/5	240U -	340U	3/9	61J	- 210J	NA	75U	
sandaracopimamic acid	0/5	240U -	340U	1/9	71U	- 92J	NA	75U	
Guaiacols:									
guaiacol	0/5	240U -	300U	1/9	19J	- 130U	NA	75U	
4,5,6-trichloroguaiacol	NA			2/9	9J	- 130U	NA	75U	
Fatty Acids:									
oleic acid	4/5	1500 -	6900	9/9	83J	-3500	NA	76J	
linoleic acid	3/5	690 -	2100	9/9	8J	-1200	NA	75U	
Dioxins:									
2,3,7,8-TCDD	2/3	0.002 -	0.007U	0/3	0.0007U-	0.0008U	NA	NA	
HpcDD (total)	NA			3/3	0.025 -	0.042	NA	NA	
1,2,3,4,6,7,8-HpCDD	NA			3/3	0.011 -	0.018	NA	NA	
OCDD (total)	NA			3/3	0.092 -	0.140	NA	NA	
Furans:									
TCDF (total)	NA			2/3	0.0006U -	0.0028	NA	NA	
2,3,7,8-TCDF	NA			2/3	0.0006U -	0.0028	NA	NA	
Herbicides/Other Pesticides:									
pentachlorophenol	5/5	7 -	160	0/9	340U	- 650U	NA	NA	
2,3,4,5-tetrachloropheno	4/5	6U -	17	NA	NA	NA	NA	NA	
triphenylphosphate	3/5	23U -	160	NA	NA	NA	NA	NA	
hexazinone	1/5	24U -	380	0/9	80U	- 140U	NA	NA	

U = not detected at detection limit shown

J = estimated concentration

B = also detected in method blank

NA = not analyzed